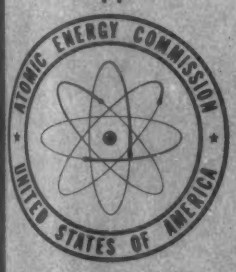
UNITED STATES ATOMIC ENERGY COMMISSION

UNIVERSITY
OF MICHIGAN
JUL 31 1956
ENGINEERING
LIBRARY

Nuclear Science Abstracts

Volume 10 No. 14 Supplement
Abstracts 4118 - 4474
July 31, 1956



Technical Information Service Extension, Oak Ridge, Tenn.

SPECIAL NOTICE

The U. S. Atomic Energy Commission has reviewed its classified reports on an accelerated basis to release the maximum amount of information possible to the national nuclear energy program. Older reports declassified in this review program are being announced in supplements to regularly scheduled issues of *Nuclear Science Abstracts*. Current unclassified AEC reports are announced routinely in the semimonthly issues of *Nuclear Science Abstracts*.

Abstracts in these supplementary issues are numbered consecutively with those in the regular issues of *Nuclear Science Abstracts* to facilitate uniform bibliographic control. The abstracts are indexed by author in each issue. Subject indexing will appear in the semiannual and annual issues of the current volume of *Nuclear Science Abstracts*. Each issue also includes a Numerical Index of Reports for the reports abstracted in the issue. This index provides availability information for each report abstracted. The semiannual and annual issues of this volume will provide complete coverage for all reports abstracted in the supplementary issues.

NUCLEAR SCIENCE ABSTRACTS

Volume 10 July 31, 1956 No. 14 Suppl.

BIOLOGY AND MEDICINE

RADIATION EFFECTS

4118 HW-18034
Hanford Works, Richland, Wash.
THE ABSORPTION AND TRANSLOCATION OF SEVERAL FISSION ELEMENTS BY RUSSIAN THISTLES. A. A. Selders. June 8, 1950. Decl. Dec. 6, 1955. 25p. Contract W-31-109-eng-52. $4.80(ph OTS); $2.70(mf OTS).

An investigation was conducted to determine the absorption and translocation of fission products by Russian thistle from a localized spot of contaminated soil. The amount and identity of the radioactive elements absorbed and translocated by the Russian thistle is given along with the location of these elements in the plants. Beta radioactivity to the amounts of 10 μc/g caused no visible effects on the growth habits of the plants. Illustrations of gross autoradiographs and of autoradiographs of sectioned material are included. (auth)

4119 HW-25191
Hanford Atomic Products Operations, Richland, Wash.
THE ABUNDANCE OF THE PRINCIPAL CRUSTACEA OF THE COLUMBIA RIVER AND THE RADIOACTIVITY THEY CONTAIN. R. W. Coopey. June 25, 1953. Decl. Jan. 5, 1956. 15p. Contract W-31-109-eng-52. $3.30(ph OTS); $2.40(mf OTS).

The species and abundance of crustacea together with the radioactivity they contained were traced for a 14-month period. Seasonal changes were found to influence the amount of radioactivity present in the organisms. Rapid growth favored high activity density. Unequal seasonal changes in radioactivity levels of body organs indicated functional differences in the utilization of the isotopes. A pronounced spring pulse and a smaller fall pulse were evident in the abundance of bottom cladocera. Radioactivity was highest during the fall pulse. Crayfish averaged 134 ± 22 g live weight and 39 ± 16 individuals per 36 square foot sampling area. Cladocera showed 2.6 g per square foot live weight and 260,000 individuals per square foot at maximum. No decrease could be found downstream from the Hanford Operation. P^{32} was the principal isotope present in crustacea, notwithstanding a variety of isotopes present in crustacean food and in the river water. (auth)

RADIATION HAZARDS AND PROTECTION

4120 CN-3190
[Chicago. Univ. Metallurgical Lab. and California. Univ., Berkeley. Radiation Lab.]
REPORT OF HEALTH ACTIVITIES [FOR] MONTH OF JULY 1945. Aug. 13, 1945. Decl. Dec. 15, 1955. 17p. Contracts W-7401-eng-37 and W-7405-eng-48a. $3.30 (ph OTS); $2.40(mf OTS).

Progress is reported in the following studies: methods for producing aerosols; methods for the determination of Pu in urine; radiation damage in mice and guinea pigs receiving chronic exposure to x and γ radiations; tissue distribution of Pu^{238}; tracer studies of the metabolism of Pu in rats; the daily rates of urinary and fecal excretion of Pu in a human subject following administration of 5 μg by intravenous injection; the use of thiophenyltrifluoroacetone for the separation of Pu in biological samples prepared for radiometric analysis; the bone deposition of Pu in pigeons; and the uptake from clay suspensions and from solutions of Pu by plants. (C.H.)

4121 HW-29298
Hanford Atomic Products Operations, Richland, Wash.
A PRELIMINARY COMPARISON OF THE NANNOPLANKTON AND NET PLANKTON OF THE COLUMBIA RIVER. R. W. Coopey. Sept. 10, 1953. Decl. Jan. 5, 1956. 11p. Contract W-31-109-eng-52. $1.80(ph OTS); $1.80(mf OTS).

Plankton collected from the Columbia River by the net method and by the centrifuge method were compared. The centrifuged plankton (nannoplankton) exceeded the net plankton in weight, in abundance of organisms, and in radioactivity. Similar seasonal trends were present in both types of plankton. (auth)

Refer also to abstract 4240.

CHEMISTRY

4122 AECD-3870
Clinton Labs., Oak Ridge, Tenn.
REMOVING TRACES OF BORON FROM BERYLLIUM OXIDE BY MEANS OF METHYL ALCOHOL. F. H. Sweeton and L. B. Rogers. May 12, 1947. Decl. Dec. 7, 1955. 8p. Contract [W-7405-eng-39]. (CL-FHS-2). $1.80(ph OTS); $1.80(mf OTS).

Tests have been made to see if a few ppm of B can be removed directly from BeO powder without chemically changing the BeO during the process. Tests using liquid CH_3CH at its boiling point (65°) were entirely unsuccessful. Likewise, no B was removed when vapor at atmospheric pressure was passed over the BeO at temperatures ranging from 153 to 265°C. Partial success was obtained when using the alcohol under pressures ranging from 24 to more than 80 atmospheres, the best results being obtained at about 210 and 260°C, in which cases the pressures are 47 atmospheres or above. The durations of the treatments were between 1 and 3 days. The concentration of B was never reduced to less than one-half of the original value, which is unsatisfactory because a successful process would need to be capable of reducing the B content from between 3 and 15 ppm down to 0.5 ppm. (auth)

4123 CF-51-5-207
Oak Ridge National Lab., Tenn.
QUARTERLY REPORT — CT-32. DISSOLVER OFF-GAS TREATMENT — ARCO — W. F. ALLAIRE. E. O. Nurmi.

May 31, 1951. Decl. Dec. 21, 1955. 17p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

From the preliminary runs to date, it is evident that the Puregas Catalytic Oxidizer provides an efficient method of removing N_2O from a mixture of gases, making it applicable for the dissolver off gas treatment. Operating at concentrations as high as 12.6% N_2O has shown less than 0.2% remaining in the exit stream. In most cases, no trace of N_2O could be found in the samples submitted. Investigations on the effect of hydrogen concentration in the inlet gas stream have shown that large excesses such as 50% or 100% are unnecessary for efficient operation. However, by supplying insufficient hydrogen (21.5% deficiency), some N_2O is present in the exhaust stream, as expected. It is felt that by utilization of the temperature changes occurring at various concentrations of N_2O and H_2, a simple operational procedure could be used at Arco which would supply complete N_2O removal using a minimum of excess hydrogen. (auth)

4124 CN-3343

California. Univ., Berkeley. [Radiation Lab.]

CHEMISTRY OF FLUORINATED β-DIKETONES. James C. Reid. Oct. 20, 1945. Decl. Dec. 20, 1955. 29p. Contract W-7405-eng-48B. Charge $4.80(ph OTS); $2.70(mf OTS).

Rates and equilibria have been measured for the keto $\rightleftharpoons$ enol process in water. All the ketones investigated resemble each other closely. The rate of enolization is first order in keto and amounts to about 1.5% per second at 20°C, and increases about three fold between 14° and 25°C. About 1% of the ketone is in the enol form at equilibrium. Hydrogen ion has little effect on either the rate or equilibrium. Equilibria have also been measured in benzene. Here about 98% of the ketone is in the enol form. Rough values of the acid strength of the enols have been determined. K_a is about 10^{-5} for all. It has been shown that the keto $\rightarrow$ enol process is not responsible for the hump in Pu extraction-time curves. Absorption spectra of trifluoroacetone have been determined in distilled water, in acid, in alkali and in ethanol. The curves are interpreted in terms of enol and enolate ion as the absorbing species. No evidence for modifications of the ketone, such as solvates was obtained. The diketones are quite stable in acid solution, but are hydrolyzed rather promptly in basic solution. Identifying characteristics of all the diketones prepared are given. (auth)

4125 ISC-606

Ames Lab., Ames, Iowa.

QUARTERLY SUMMARY RESEARCH REPORT IN CHEMISTRY FOR JANUARY, FEBRUARY, AND MARCH 1955. June 10, 1955. Decl. Jan. 6, 1956. 24p. Contract W-7405-eng-82. $4.80(ph OTS); $2.70(mf OTS).

The production of heavy rare earths and yttrium is reviewed. Lattice constants are presented for the rare earth metals. Phase studies of the La–C system are reported. The chemical reactions of Nb_2O_5 in HF were studied. Experiments were carried out on the liquid metal extraction of several artificial fission product–uranium mixtures. Phase studies were made of U–Sb alloys. EDTA has been used to determine rare earths in thorium. Decay properties of Te^{127} and Te^{129} are being studied. Yield determinations of photonuclear reactions by x rays are continued. The effects of radiation on the Co in the cobalt complex of ethylenediamine and on the As in tetraphenylarsonium chloride were studied. The theoretical molecular orbital treatment of transition metal complexes is extend tetrahedral complexes. (C.W.H.)

4126 MonC-422

Clinton National Lab., Oak Ridge, Tenn.

THE DETERMINATION OF REDUCING SUBSTANCES IN HEXONE SOLUTIONS. J. P. McBride. Nov. 17, 1947. Decl. Jan. 5, 1956. 15p. Contract W-35-058-eng-71. $4.80(ph OTS); $2.70(mf OTS).

The system, water-acetic acid-hexone, has been partially delineated on a percent by volume basis. Data are presented on the use of cerate in the determination of oxalate and hexone reducing power in acetic acid media and the results compared with those obtained by the use of the dichromate procedure for total reducing power. The aging of hexone-nitric acid solutions is shown to change the absorption spectra of the freshly prepared solution by giving increased but continuous absorption in the visible range with no evidence for the production of nitrous acid. Data are given which indicates that nitrous acid has a characteristic absorption spectra in hexone and water. A determination for hydrazine using iodate is presented. (auth)

4127 ORNL-1209

Oak Ridge National Lab., Tenn.

THE REACTION BETWEEN HYDROGEN AND OXYGEN BY CATALYSIS AND THE THERMAL REACTION. D. W. Kuh A. D. Ryon, and A. A. Palko. Jan. 15, 1952. Decl. Jan. 5, 1956. 26p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

The reaction between H_2 and O_2 with the aid of various catalysts (especially Pt on alumina) has been studied, and the operating variables such as flow rates, space velocity, temperature, and gas composition have been examined. It has been found that H_2 and O_2 in stoichiometric proportions and mixed with either steam or He may be made to react to the extent of 99.5% or greater at space velocities up to 30,000 hr^{-1}, or even higher, at temperatures from 100° to 900°C, and with mixtures ranging from less than 1% H_2 to mixtures containing 12% H_2 and 6% O_2. Richer mixtures, including undiluted electrolytic gas ($H_2 + \frac{1}{2} O_2$) have been used with catalysts less active than Pt (e.g. Cu, Ag, Ni, and V_2O_5) but here the gas mixture is explosive and care must be taken to prevent explosions. The thermal reaction between H_2 and O_2 diluted with steam has also been investigated at temperatures between 500° and 800°C. (auth)

4128 SOO-2

Bureau of Mines. Central Experiment Station, Pittsburgh.

LIMITS OF INFLAMMABILITY AND IGNITION TEMPERATURES OF HEXONE IN AIR AND IN OTHER GASEOUS ATMOSPHERES. July 18, 1949. INFLAMMABILITY AND IGNITION TEMPERATURE OF RMW. Aug. 23, 1949. Mary G. Miles. Decl. Nov. 29, 1955. 15p. $3.30(ph OTS $2.40(mf OTS).

The limits of inflammability of hexone in dried air were found to be 1.40 and 7.50% by volume for the lower and upper limits, respectively. Addition of 1% NO_2 lowers the lower limit to 1.33%; of 2.5%, to 1.30; of 5%, to 1.26. The minimum O_2 concentration required for the propagation of flame was found to be 11.10% by volume for dry hexone–air–nitrogen mixtures; 11.74% for similar mixtures containing 3.25% water vapor; 10.56% for similar, dry mixture containing 5% NO_2. The minimum ignition temperatures (drop method) were found to be 459°C in air; 407°C in air containing 1% NO_2; and 381°C in air containing 5% NO_2.

The upper limit of inflammability of RMW in dry air is 7.90% by volume. The minimum oxygen concentration required to propagate flame in dried RMW–oxygen–nitrogen mixtures was 10.5% by volume. The minimum ignition temperature of RMW in air is 362°C with a lag of 5.6 seconds. (auth)

4129 Y-461

Carbide and Carbon Chemicals Corp. Y-12 Plant, Oak Ridge, Tenn.

THE ACID PROCESS FOR CARNOTITE ORES. K. B. Brown and G. H. Clewett. Aug. 9, 1949. Decl. Dec. 8, 1955. 26p. Contract W-7405-Eng-26. $4.80(ph OTS); $2.70(mf OTS).

The acid process for recovering uranium and vanadium from carnotite ores consists of roasting of the ore with salt (NaCl) at a high temperature, leaching of the calcines with water to dissolve most of the V as water-soluble $NaVO_3$, re-leaching of the water-leached calcines with a dilute solution of HCl to dissolve almost all of the U along with additional quantities of V, precipitation of the V from the water solution as "red cake," and separation of U and V from the acid leach liquor by a process which ultimately yields the U as a sodium uranate and the V as an Fe vanadate, the iron vanadate being recycled to the salt-roast. The hydrochloric acid for the leaching step is produced in the process itself by scrubbing out the HCl gas that is formed in the salt-roasting treatment. (auth)

AEROSOLS

4130 Y-685

Oak Ridge National Lab., Y-12 Area, Tenn.

FILTRATION OF SO_3 GAS MOLECULES BY TYPE 6 PAPER. J. W. Thomas. Nov. 9, 1950. Decl. Jan. 7, 1956. 16p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Sulfur trioxide is quantitatively sorbed by two layers of Type 6 paper contained in the E1R2 aerosol canister. It is inferred that the radioactive products of rare gases would also be adsorbed by the canister. (C.W.H.)

4131 Y-700

Oak Ridge National Lab., Y-12 Area, Tenn.

PREPARATION OF RADIOACTIVE METHYLENE BLUE FROM S^{35} LABELED SODIUM THIOSULFATE. H. R. Bronstein and E. G. Struxness. Dec. 13, 1950. Decl. Jan. 5, 1956. 15p. Contract W-7405-eng-26. $3.40(ph OTS); $2.40(mf OTS).

Methylene blue-S^{35} has been prepared from sodium thiosulfate-S^{35} by a modification of Bernthsen's method. Yields ~60% were obtained. Methylene blue is used as an agent for evaluating the efficiencies of smoke filters against particulate aerosols. (C.W.H.)

ANALYTICAL PROCEDURES

4132 A-129

National Bureau of Standards, Washington, D. C.

SPECTROGRAPHIC DETERMINATION OF BORON IN URANIUM OXIDE BY THE PYROELECTRIC CONCENTRATION METHOD. Bourdon F. Scribner and Harold R. Mullin. Mar. 20, 1942. Decl. Jan. 16, 1956. 9p. $3.30(ph OTS); $2.40(mf OTS).

A spectrographic procedure for the determination of trace concentrations (~1 ppm) of boron in U_3O_8 is presented. Uranium metal or its salts must be converted to the oxides prior to the analysis. (C.W.H.)

4133 A-176

National Bureau of Standards, Washington, D. C.

DETERMINATION OF THE CHLORINE-OXYGEN RATIO IN THE ELECTROLYSIS OF URANYL CHLORIDE SOLUTIONS. Walter J. Hamer. May 20, 1942. Decl. Jan. 16, 1956. 9p. $1.80(ph OTS); $1.80(mf OTS).

During electrolysis of a UO_2Cl_2 solution, the current efficiency for Cl_2 production was measured under certain operating conditions and expressed as the Cl_2-O_2 ratio of anode-liberated gas. (T.W.S.)

4134 A-1240

Columbia Univ., New York. Div. of War Research.

ANALYSIS OF PURE CRYSTALLINE BORON. C. M. Judson. Feb. 11, 1944. Decl. Dec. 8, 1955. 19p. Contract W-7405-eng-50. (100B-R-55). $3.30(ph OTS); $2.40(mf OTS).

The B is dissolved in a mixture of H_2SO_4 and HNO_3. The solution is diluted and neutralized with Na_2CO_3. The CO_2 is removed by boiling an acid solution. The strong acid present is titrated to a pH of 5. Mannitol is added, converting the boric acid to a relatively strong complex acid which can be titrated with NaOH to a pH of 9. The method is the conventional one for the analysis of boric acid. The only original contribution is the method of dissolving the sample. Variations in the method required for the analysis of impure materials are described. An analysis of the data indicates that a precision of 0.2% is being obtained. The possibility of improving the precision is discussed, along with the possibility of decreasing the size of the sample. (auth)

4135 A-2301

Brown Univ., Providence.

THE DETERMINATION OF R [U] BY EXTRACTION METHODS. Charles A. Kraus. Nov. 30, 1944. Decl. Jan. 16, 1956. 28p. Contract W-7405-eng-73. (BT-40). $4.80(ph OTS); $2.70(mf OTS).

The U content of gunk solutions may be determined with resonable speed and accuracy by extracting hexavalent U from aqueous nitrate solution by means of a suitable polyether, such as dibutoxytetraethylene glycol or dibutyl carbitol, removing the element from the ether solution by washing with $(NH_4)_2SO_4$ solution, precipitating as $(NH_4)_2U_2O_7$, and igniting to U_3O_8. Under ordinary conditions, with samples containing from 0.3 to 0.6 g of U in 100 cc of solution, the determination may be carried out in 3 to 4 hr and within an accuracy of 0.5%. With certain modifications, the method may be readily applied to the analysis of solutions containing as little as 0.01 g of U in 100 to 500 cc of solution and many times this amount of Fe. Special methods have also been developed for analyzing solutions containing 1 ppm. of U or less. (auth)

4136 A-2707

Purdue Univ., Lafayette, Ind.

A MODIFIED MERCURY CATHODE CELL FOR THE PURIFICATION OF URANIUM SOLUTIONS AND THE REDUCTION OF URANIUM. E. S. Gantz, W. S. Barnhart, T. DeVries, and M. G. Mellon. Mar. 8, 1946. Decl. Dec. 8, 1955. 10p. Contract W-7405-eng-74. $3.30(ph OTS); $2.40(mf OTS).

A modified mercury cathode cell having a separate anode compartment has been designed and tested. This cell permits the simultaneous purification and reduction of U solutions in preparation for subsequent titration. The rate of

removal of various impurities (principally Fe and Cr) has been studied and the conditions for the purification of Purdue pilot-plant samples have been established. (auth)

4137 A-2708

Purdue Univ., Lafayette, Ind.

THE ALKALINE PEROXIDE COLORIMETRIC DETERMINATION OF URANIUM. B. F. Rider, C. V. St. John, and M. G. Mellon. Mar. 8, 1946. Decl. Dec. 8, 1955. 14p. Contract W-7405-eng-74. $3.30(ph OTS); $2.40(mf OTS).

A Beckman spectrophotometer was used to determine the effect of reagent concentration, order of addition of reagents, pH, temperature, stability of color, U concentration, and interfering substances on the yellow coloration produced by the uranyl ion in the presence of alkaline H_2O_2. Selection of wavelength for measurement, sensitivity, range, calibration, Beer's law conformity, precision and accuracy are discussed. Precipitation, electrolysis, and extraction separations are described. The procedure recommended is simple and reproducible. The color develops immediately in the pH range 11 to 14. As little as 1 ppm can be measured in 10 cm cells with an accuracy of 1 to 3%. (auth)

4138 AECD-3879

Tennessee Eastman Corp., Oak Ridge, Tenn.

DETERMINATION OF URANIUM BY FLUORESCENCE. W. R. Grimes and F. E. Clark. May 28, 1948. Decl. Jan. 5, 1956. Contract W-7401-eng-23. (H-1.740.10(Paper No. 3)). $9.30(ph OTS); $3.60(mf OTS).

The U content of badly contaminated U solutions may be determined quickly using visual comparison methods to an accuracy of ± 15%. This accuracy may be considerably improved by employing the fluorimeter herein described. Interfering ions and their removal using liquid-liquid extractions are considered. (auth)

4139 AECD-3881

Carbide and Carbon Chemicals Corp. Y-12 [Plant], Oak Ridge, Tenn.

USE OF 1-ASCORBIC ACID AS A COLORIMETRIC REAGENT FOR URANIUM. C. D. Rothenberger and W. R. Grimes. June 9, 1947. Decl. Jan. 5, 1956. 32p. Contract [W-7405-eng-26]. (H-4.360.13). $6.30(ph OTS); $3.00(mf OTS).

Hexavalent uranium in weakly acid solution produces with a large excess of ascorbic acid a yellow-brown color whose intensity under certain conditions is a linear function of uranium concentration. Chloride, nitrate, perchlorate, along with Fe, Cd, Mn, Na, Ca, Sn, Mg, and Th are without effect on the color while phosphate, sulfate, fluoride, citrate, tartrate, oxalate, chromium, and vanadium and moderate amounts of Ni, Zn, Mo, and Al interfere. A rapid ether extraction procedure for purification of the uranium has been developed. (auth)

4140 AECD-3995

Carbide and Carbon Chemicals Co., Y-12 Area, Oak Ridge, Tenn.

PROCEDURES FOR URANIUM SPECTROGRAPHY. R. C. McIlhenny, ed. July 31, 1952. Decl. Jan. 6, 1956. 59p. Contract W-7405-eng-26. (Y-B41-543). $9.30(ph OTS); $3.60(mf OTS).

Analytical procedures for use in uranium spectrography are outlined. General instructions applicable to all spectrographic work are included. (C.H.)

4141 AECD-4015

Oak Ridge National Lab., Y-12 Area, Tenn.

STATISTICAL QUALITY CONTROL REPORT FOR OCTOBER 1951. C. D. Susano and R. L. McCutchen. Nov. 29, 1951. Decl. Jan. 16, 1956. 34p. Contract W-7405-eng-26. (Y-B31-309). $6.30(ph OTS); $3.00 (mf OTS).

A series of 1055 control determinations were made to determine the effect of certain modifications in chemical procedures on the accuracy and precision of the test results obtained. Procedures included both fluorimetric and colorimetric methods for the determination of U; colorimetric methods for the determination of V; a fluorimetric method for the determination of U in Bartow clay leach solutions; and methods for the analysis of uranyl sulfate solutions containing small amounts of U for the presence of Fe, Ni, Cr, and Mn. A statistical analysis of test results is included. (C.H.)

4142 CN-1791

Chicago. Univ. Metallurgical Lab.

HEW ANALYTICAL DEVELOPMENT PROGRAM. June 1, 1944. Decl. Dec. 15, 1955. 33p. (A-2621). $6.30(ph OTS); $3.00(mf OTS).

A report on the progress of the HEW Analytical Development program is presented. Remote control and safety devices are discussed in only general terms; however, a fairly detailed report on the progress made in the development of analytical methods for each element involved at Hanford is tabulated. Also, complete research reports on the determination of nitrate, manganese, phosphate and silica are included. (auth)

4143 HW-25205

Hanford Works, Richland, Wash.

THE DETERMINATION OF AMERICIUM IN PLUTONIUM PRODUCT SOLUTIONS. A. Chetham-Strode, Jr. Aug. 15, 1952. Decl. Jan. 6, 1956. 6p. Contract W-31-109-eng-52. $1.80(ph OTS); $1.80(mf OTS).

The cerium fluoride method for the determination of Am in the presence of Pu and U has been extended, with modifications to application to plant streams of very high Pu to Am ratios. The precision of the modified method has been determined to be ± 2.24% at the 99% limits. (auth)

4144 HW-33486

Hanford Atomic Products Operation, Richland, Wash.

A COMPARISON OF ANALYTICAL METHODS FOR AMERICIUM. M. W Gift. Oct. 22, 1954. Decl. Jan. 6, 1956. 18p. Contract W-31-109-eng-52. $3.30(ph OTS); $2.40(mf OTS).

The ratio of TPB–TTA to CeF_3 recoveries was 1.05 with a standard deviation of ±0.028. The deviation from unity might be due to absorption losses in the CeF_3 method. Comparison of radiation exposures indicated a better decontamination by the TBP–TTA method, with consequent lower exposures to the laboratory worker. (L.M.T.)

4145 HW-34141

Hanford Atomic Products Operation, Richland, Wash.

THE FLAME PHOTOMETRIC DETERMINATION OF TRIBUTYLPHOSPHATE. D. W. Brite. Dec. 15, 1954. Decl. Jan. 6, 1956. 16p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The determination of TBP in hydrocarbon solutions throughout the range 0.01 to 80% TBP may be performed using the flame photometer. The principal conclusions resulting from the study may be summarized as follows: A relative precision of ±2% (95% confidence level) was found in the range 1 to 2% TBP, whereas, the relative precision at the 45% TBP level was only about ±4% due to the error in reproducing the extremely narrow slit width setting re-

quired in this range. HNO_3, $UO_2(NO_3)_2$, and $Th(NO_3)_4$ interfere if present in concentrations of several gm/l. Interference by all three materials may be eliminated by contacting the solution with H_2O or Na_2CO_3 solution. A single determination, including preparation of a standard curve, may be made in 15 min. Multiple determinations may be made at a rate of one to two minutes per determination. A modification of an existing method makes possible the application of this method to the determination of TBP dissolved in aqueous samples. A relative precision of ±5% (95% confidence level) is obtained. (auth)

4146 KAPL-181
Knolls Atomic Power Lab., Schenectady, N. Y.
THE PREPARATION OF UNIFORM FILMS FOR SPONTANEOUS FISSION COUNTING. Leonard P. Pepkowitz and Edwin L. Shirley. Nov. 8, 1950. Decl. Jan. 10, 1956. 10p. Contract W-31-109-eng-52. $1.80(ph OTS); $1.80 (mf OTS).

Two procedures have been devised for the preparation of very uniform, adherent, relatively thick foils (0.3 mg/cm^2) for the KAPL alpha experiment. The first, designated as the glycerine-aerosol technique, is applicable to U, Np, and Pu, whereas the second, called the glycerine pool technique, has been applied successfully only to U. The special merit of the glycerine pool technique is that U films can be deposited on extremely thin backing materials such as 0.1-mil Al. Characteristics of the films, advantages of the methods, and detailed procedures are given. 3 figures. (C.H.)

4147 M-4330
[Rochester, N. Y. Univ.]
A STUDY OF THE VALIDITY OF U IN URINE DETERMINATIONS MADE BY SIX DIFFERENT LABORATORIES. M. J. Wantman and D. V. Tiedeman. [nd]. Decl. Dec. 5, 1955. 14p. Contract [W-7401-eng-49]. $3.30(ph OTS); $2.40(mf OTS).

An evaluation was made of the various methods in use in 1945 for the analysis of urine for U content. Identical sets of 30 urine samples were distributed to 7 participants in the study. A statistical analysis of results is presented. (C.H.)

4148 ORNL-599
Oak Ridge National Lab., Tenn.
ESTIMATION OF TRIBUTYL PHOSPHATE (TBP) IN MIXTURES OF TBP-VARSOL. M. T. Kelley, P. F. Thomason, A. D. Horton, and J. L. Horton. Feb. 21, 1950. Decl. Jan. 6, 1956. 13p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

Two methods for the estimation of tributyl phosphate in mixtures of TBP-Varsol are given. The first procedure involves the colorimetric analysis for phosphate following an acid or a micro combustion bomb decomposition of the mixtures. The second and preferred method depends on the measurement of the dielectric constant of the mixtures. (auth)

4149 ORNL-961
Oak Ridge National Lab., Tenn.
A SOLVENT EXTRACTION METHOD FOR NEPTUNIUM (237) ANALYSIS. Fletcher L. Moore. July 10, 1951. Decl. Jan. 6, 1956. 15p. Contract W-7405-eng-26. $3.30 (ph OTS); $2.40(mf OTS).

A rapid and quantitative radiochemical method for the analysis of Np^{237} is described. The method is based on the extraction of neptunium (IV) with thenoyltrifluoracetone in xylene. Neptunium^{237} is separated free from other alpha emitters and from non-radioactive interferences, and the method may be readily adapted to remote control. (auth)

4150 Y-825
Oak Ridge National Lab., Y-12 Area, Tenn.
DETERMINATION OF THE PHTHALATE ION IN PROCESS RECYCLE LIQUORS. A STUDY OF THE REACTION BETWEEN PHTHALIC ANHYDRIDE AND AMMONIUM HYDROXIDE. W. K. Miller and R. Rowan, Jr. Nov. 5, 1951. Decl. Jan. 6, 1956. 29p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

An ultraviolet spectrophotometric method has been developed for the determination of the phthalate ion in recycle liquors from the Zr refining process. Direct density readings at 276 mμ in acid solution and at 271 mμ in basic solution are measures of the phthalate concentration. Although Zr is being precipitated as zirconyl phthalate in the Zr refining process, the feed solution, prepared by adding NH_4OH to an aqueous suspension of phthalic anhydride, has been proved to be ammonium phthalamidate instead of ammonium phthalate. The amido group is hydrolyzed in the hot, acid solution to produce phthalic acid, which is the precipitating agent. (auth)

Refer also to abstracts 4198, 4213, 4225, and 4236.

FLUORINE AND FLUORINE COMPOUNDS

4151 A-2586
Du Pont de Nemours (E. I.) & Co., Wilmington, Del.
CHAMBERS WORKS PROCESS FOR THE MANUFACTURE OF SILVER DIFLUORIDE (FROM SILVER CHLORIDE) AT BLUE PRODUCTS AREA (M. W. 145.9). W. F. Huxtable. Jan. 10, 1945. Decl. Jan. 17, 1956. 4p. Contract W-7412-eng-2. (B.P.-20). $1.80(ph OTS); $1.80(mf OTS).

AgCl is treated in the dry state with F_2 gas at progressively elevated temperatures (75 to 180°C). AgF is formed as an intermediate, the end product being AgF_2. Yield is 95%. (G.Y.)

4152 CC-2723
[Ames Lab., Ames, Iowa]
PYROHYDROLYSIS IN THE ANALYSIS OF FLUORIDES AND OTHER HALIDES. Problem Assignment No. 7. W. D. Cline. June 30, 1945. Decl. Dec. 20, 1955. 27p. Contract W-7405-eng-82. $4.80(ph OTS); $2.70(mf OTS).

Fluorides and other halides are hydrolyzed completely by passing a rapid stream of superheated steam over the sample near 1000°C in a specially designed platinum reaction tube. The steam and hydrogen halide are condensed by cooling, and the resulting distillate titrated with standard sodium hydroxide solution. The fluorides and chlorides of the light metals, hitherto thought of as very difficult to hydrolyze, are mixed with U_3O_8, or other metallic oxide, which reacts with the products of hydrolysis, thus shifting the equilibrium so that the reaction is complete in a comparatively short time. A description of the apparatus, including photographs, the recommended method of procedure, hydrolysis-rate graphs, and suggestions for further applications of the method are given. (auth)

LABORATORIES AND EQUIPMENT

4153 AECD-4067
Knolls Atomic Power Lab., Schenectady, N. Y.
A MINIATURE MIXER-SETTLER. H. W. Alter, B. V.

Coplan, E. L. Zebroski. Dec. 21, 1950. Decl. with deletions Jan. 5, 1956. 40p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

A minature mixer-settler has been developed that fulfills the requirements for a laboratory extraction unit and overcomes the disadvantages of the batch countercurrent units commonly used. The construction and operation of the unit are reviewed, and design drawings are given. (D.E.B.)

4154 CN-1869

Clinton Labs., Oak Ridge, Tenn.

EQUIPMENT DECONTAMINATION. Problem Assignment No. 242-X21AS. Progress Report [for] May 1, 1944 to July 15, 1944. Aug. 21, 1944. Decl. Jan. 4, 1956. 18p. Contract [W-7405-eng-39]. (A-2804). $4.80(ph OTS); $2.70(mf OTS).

Samples of 25-12 stainless steel that were contaminated by immersion in the semi-works #1 precipitator, catch tank, or neutralizer were almost completely decontaminated, without significant corrosion, by immersion in 35 to 60% HNO_3 at 65°C for ½ hour, followed by either immersion in 5 to 20% NaOH solution containing 1¼ to 10% sodium tartrate at 65°C for ½ hour, or immersion in 10% HNO_3-1% HF at room temperature for ½ hour, or immersion in 10% $ZrO(NO_3)_2$-5% HNO_3 at 65°C for ½ hour. On semi-works catch tank samples, which had no visible deposit of $BiPO_4$, the hot concentrated HNO_3 treatment gave decontamination factors of 5 to 20, with factors of 20 to 300 for the second treatments, giving over-all factors of 200 to 2000. The three second treatments listed are in order of decreasing effectiveness. Corrosion rates on 25-12 during treatment were only 0.00009 inches per month on heat-treated samples, and 0.0005 inches per month on un-heat-treated ones. The procedure normally to be recommended for decontamination of process equipment consists of treatment with 35% to 60% HNO_3 at 65°C or higher for one or two hours, to dissolve $BiPO_4$ residues and HNO_3-soluble activity, followed with 5% NaOH containing 1¼% sodium tartrate for an hour at 65°C or higher. For any process vessel that may contain ceric phosphate scavenger, 1 to 2% H_2O_2 should be added to the HNO_3 wash, to reduce the ceric to the soluble cerous phosphate. To prevent decomposition of the peroxide before it reaches the contaminated vessel, the H_2O_2 should be added directly to each vessel involved, as 30% H_2O_2 solution, just before the HNO_3 solution is charged. Solutions of sixteen materials were tested on one inch by one inch panels for use as water-soluble coatings for cell walls and equipment pieces. Those with promising film-forming and water solubility characteristics were given preliminary decontamination tests on this small scale. Of these, Tapoganth, a tapioca starch dextrine, was the most attractive, and Cellosize and sodium cellulose glycolate were promising. Only the Tapoganth formulations have so far been tested on a larger scale. In one-gallon scale tests, solutions of one part Tapoganth in three and one-half parts water were found to be suitable for brush application, and one in four for spraying with standard paint spray equipment. In each case $CaCl_2$ equal to 10% of the solution weight was added to prevent cracking and chipping off of the film on drying. Decontamination tests with active Clinton plant solutions on four foot by four foot Ucilon-painted panels showed that the application of four to six spray coats of the Tapoganth–$CaCl_2$ solution before contamination, with subsequent washing with two gallons of cold water per square foot of surface (equivalent to nine thousand gallons per Hanford cell), gave essentially complete decontamination of the panels, i.e., down to 1 mr/hr or less at three inches distance. The actual decontamination factors obtained depended primarily on the activities of the contaminating solutions applied. With the most active solution used (plant 11M) a decontamination factor of 118 was obtained, compared to 15 obtained by washing the uncoated Ucilon surface. (auth)

RADIATION CHEMISTRY

4155 CC-648

Chicago. Univ. Metallurgical Lab.

CHEMICAL RESEARCH—RADIATION CHEMISTRY. REPORT FOR MONTH ENDING MAY 15, 1943. [nd]. Decl. Dec. 13, 1955. 18p. $4.80(ph OTS); $2.70(mf OTS).

Progress is reported in studies on the effects of β and γ radiation on the electrical resistance of insulating materials; gas evaluation from Press-wood following β and deuteron bombardment; the effect of current on H_2O_2 production in water containing iodine at several concentrations, CO_2, aerated water, and deoxygenated water; H_2O_2 production in reactor cooling water; the production of H_2O_2 in deoxygenated water by recoil protons from the scattering of fast neutrons; and the effects of radioactive solutions on glass electrodes. (C.H.)

RADIATION EFFECTS

4156 AECD-3883

North American Aviation, Inc., Downey, Calif.

FORMATION OF NITROGEN OXIDES BY ALPHA PARTICLE IRRADIATION OF THE SYSTEM N_2-CO_2. M. E. Steidlitz and M. H. Feldman. Feb. 18, 1953. Decl. with deletions Jan. 10, 1956. 12p. Contract AT-11-1-gen-8. $3.30(ph OTS); $2.40(mf OTS).

The reaction between nitrogen and carbon dioxide, under irradiation with 40 Mev alpha particles from the Berkeley 60 inch cyclotron, was studied at gas temperatures near 50°C and total pressures of about 600 millimeters of Hg, contained in Pyrex capsules. The range of gas compositions investigated included the pure components, as well as mixtures with and without trace oxygen. In all mixtures, a steady state concentration of nitrogen oxides of about 0.15 millimeter was reached after a few microampere hours exposure. The mass-spectrometer analytical procedure employed did not permit identification of the individual species of oxides present. (auth)

4157 ORNL-1325

Oak Ridge National Lab., Tenn.

RADIATION DAMAGE TO ORGANIC ION-EXCHANGE MATERIALS. I. R. Higgins. Mar. 16, 1953. Decl. Dec. 30, 1955. 14p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

The stability of polystyrene and phenolic ion-exchange resins to radiation from a Co^{60} source from absorbed $Ce^{144}-Pr^{144}$ was investigated. Sulfonated polystyrene cation-exchange resins lost 10 to 20% of their capacity per watt-hour of radiation absorbed per gram of oven-dry resin, while the quaternary amine anion-exchange polystyrene resins lost about 40%. Phenolic cation-exchange resins lost only 1%. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

4158 ISC-337
Ames Lab., Ames, Iowa.
QUARTERLY SUMMARY RESEARCH REPORT IN CHEMISTRY FOR JANUARY, FEBRUARY AND MARCH, 1953. June 29, 1953. Decl. Jan. 7, 1956. 26p. Contract W-7405-eng-82. $4.80(ph OTS); $2.70(mf OTS).

The physical and inorganic groups report progress on rare earth metallurgy; heats of solution of Yb, Dy, and Ho; and reaction between water vapor and Li. The analytical chemistry groups present a method for estimation of Th and Ce in a mixture of the two and a sulfate determination. Spectrographic determination of low concentrations of Zr in Hf, analysis of rare earths by x-ray-fluorescence spectroscopy, and infrared spectra of aromatic compounds are presented by the spectrochemistry group. The radiochemistry groups report on the metallurgical separation and characterization of radioisotopes. The x-ray chemistry group reports the structure of Sm and the H-bonding and structure of ice. With the exception of rare earth production data, the information has been published elsewhere. (For preceding report see ISC-321.) (G.Y.)

SEPARATION PROCEDURES

4159 A-1099
Brown Univ., Providence.
INVESTIGATIONS RELATING TO THE USE OF POLYETHERS FOR THE EXTRACTION OF R [U] AND Fe FROM AQUEOUS SOLUTION. Charles A. Kraus. Sept. 30, 1944. Decl. Jan. 17, 1956. 37p. Contract W-7405-eng-73. (BT-38). $6.30(ph OTS); $3.00(mf OTS).

Investigations relating to the use of polyethers as extraction agents for the purpose of separating uranyl nitrate from aqueous solution containing such impurities as Fe, Cr, Cu, and Ni are reported. Of the polyethers investigated, the triether, dibutyl "Carbitol," $C_4H_9(OC_2H_4)_2OC_4H_9$, appears the most readily applicable to use on a large scale. A pentaether, dibutoxytetraethylene glycol, $C_4H_9(OC_2H_4)_4OC_4H_9$, is an even more powerful extraction agent than the triether. However, this ether is somewhat more difficult to produce commercially. The coefficients obtained with dibutyl "Cellosolve," $C_4H_9(OC_2H_4)OC_4H_9$, are quite low and the solvent could probably only be employed in a process employing a column; diethyl Cellosolve is very soluble in H_2O, which would necessitate the installation of solvent recovery operations; ethylbutyl cellosolve and dimethyl dioxane have not been studied extensively since these solvents appeared to be unstable under the conditions encountered in extraction. $Ca(NO_3)_2$ is the most satisfactory salting out agent for use in combination with dibutyl carbitol. With NH_4NO_3 the partition coefficient is fairly low; but NH_4NO_3 has several applications for analytical purposes when used in combination with pentaether. $Fe(NO_3)_3$ may also be employed as salting out agent, but considerable amounts of Fe are extracted by the organic solvents. $Cu(NO_3)_2$, although a powerful salting out agent, is somewhat soluble in the organic phase and promotes the distribution of Fe unduly. After extraction, the U may be most readily removed from the oragnic phase by washing with $(NH_4)_2SO_4$ solution. A process has also been studied in which Fe is complexed with thiocyanate and extracted by either the tri- or pentaether. Cu also is completely extracted under the above conditions (at least when present in low concentration), while the Cr remains dissolved in the aqueous phase. (G.Y.)

4160 A-2308
Brown Univ., Providence.
INFLUENCE AND CONTROL OF ACID IN THE BATCH-WISE EXTRACTION PROCESS. Charles A. Kraus. Mar. 22, 1945. Decl. Jan. 16, 1956. 47p. Contract W-7405-eng-73. (BT-47). $7.80(ph OTS); $3.30(mf OTS).

The role of acid in the extraction of U from gunk solutions by dibutyl carbitol (bis(2-butoxyethyl) ether), using $Ca(NO_3)_2$ or $Cu(NO_3)_2$ as salting-out agents, was studied. A method was developed to determine rapidly the excess acid in the carbitol phase in the presence of U: the phase is titrated with n-amylamine using bromphenol blue as indicator. The stability of the gunk solutions as a function of the acid lost by one or more carbitol extractions, the effect of acid on the distribution coefficients for U and Fe, and the use of the glass electrode in estimating acidity of gunk solution were studied. (G.Y.)

4161 AECD-3934
Tennessee Eastman Corp., Oak Ridge, Tenn.
DISTRIBUTION COEFFICIENTS OF HNO_3 IN THE SYSTEM DIBUTYL CARBITOL–NITRIC ACID. Buddy Warren and C. D. Susano. Sept. 10, 1945. Decl. Dec. 20, 1955. 13p. Contract W-7401-eng-23. (C-3.375.3). $3.30(ph OTS); $2.40(mf OTS).

The distribution coefficient of HNO_3, (K_d = [HNO_3] organic/[HNO_3] aqueous) increases from 0.460 to 0.520 when dibutyl carbitol is in contact with HNO_3 solution as the HNO_3 concentration increases from 3.25 to 15.6 N; K_d remains constant when the HNO_3 concentration of the aqueous phase is below 2.25 N. In the absence of other substances, apparently no reaction takes place between HNO_3 and butyl carbitol or, if so, it is one which gives a product which hydrolyzes readily. (auth)

4162 AECD-4063
Massachusetts Inst. of Tech., Watertown, Mass. Mineral Engineering Lab.
LEACHING OF NITRATED MATERIALS WITH ORGANIC SOLVENTS. A. M. Gaudin, Paul Galvanek, Jr., John Dasher, and David Kaufman. [1949?]. Decl. Jan. 10, 1956. 10p. (MITG-S-10). $1.80(ph OTS); $1.80(mf OTS).

Uranium leach precipitates containing 1 to 10% U were treated with HNO_3, dewatered to a paste or dried completely, then leached with diethyl ether containing some added HNO_3. It was found that all of the U dissolved in the ether leach liquor. This led to the conception and realization of a U extraction process in which a non-aqueous nitrated liquor is the solvent, and in which solids are extracted with this solvent in the absence of H_2O or the presence of a minor quantity only of an aqueous phase. The process was aimed at extraction with general purification rather than at ultimate purification of U. (L.M.T.)

4163 ANL-4248
Argonne National Lab., Lemont, Ill.
TTA EXTRACTION OF DILUTE SOLUTIONS OF THORIUM NITRATE AND URANYL NITRATE. Earl K. Hyde and Jean Tolmach. [nd]. Decl. Dec. 14, 1955. 12p. Contract W-31-109-eng-38. $3.30(ph OTS); $2.40(mf OTS).

Thorium (in the concentration range 0.026 to 0.0026 M) is quantitatively extracted from aqueous solutions, pH $\geq$ 1, by benzene solutions of TTA; uranium is incompletely ex-

tracted under these conditions. Salting agents appear to have negligible effect on Th extraction. (C.W.H.)

4164 CC-2636
Chicago. Univ. Metallurgical Lab.
CHEMICAL RESEARCH—EXTRACTION AND PROPERTIES OF U^{233}. REPORT FOR PERIOD ENDING DECEMBER 15, 1944. Jan. 27, 1945. Decl. Dec. 13, 1955. 36p. (Includes Supplement). Contract W-7401-eng-37. $6.30 (ph OTS); $3.00(mf OTS).

A study is reported on the radiation spectrum of pure U^{233}, determination of the half life and decay chain of U^{233}, extraction of U^{233}, extracting solvents for U, extraction of HNO_3 and Th by ether from $Th(NO_3)_4$ and ammonia, effect of nitrates on the extraction of U and Th by ether, and analysis of ore samples for Pa. (J.E.D.)

4165 CF-51-4-174
Oak Ridge National Lab., Tenn.
TWO ALTERNATE DISSOLVER OFF-GAS TREATMENT PROCESSES. S. H. Jury. Apr. 18, 1951. Decl. Dec. 21, 1955. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Two recovery processes for dissolver off-gas treatment are described and compared. (J.E.D.)

4166 CF-51-7-149
Oak Ridge National Lab., Tenn.
ACTIVITY LEVELS IN OFF-GAS SYSTEM. H. O. Weeren. July 20, 1951. Decl. Dec. 20, 1955. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Calculations were made to determine the intensity of radiation that will be given off by the iodine unit, the charcoal bed, and by the gases released from the charcoal bed during regeneration. These calculations are for the maximum amount of radiation; the actual levels will probably be much lower. It was found that the iodine unit will retain 70,583.9 c and the charcoal bed 96,158 c. It was also found that a one ml. sample of the gases leaving the charcoal bed during regeneration will have an activity of 7.4 mr/hr and that 864 Btu/hr of heat will be produced in the charcoal bed by the activity of the gases there. (auth)

4167 CF-52-1-30
Oak Ridge National Lab., Tenn.
FLOWSHEETS FOR SEVERAL FISSILE MATERIALS PRODUCTION TECHNOLOGY PROCESSES. William H. Sullivan. Jan. 7, 1952. Decl. Jan. 5, 1956. 4p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Flowsheets for U processing from ore to UF_6, production of pure Th, and production of Hf-free Zr are given. (D.E.B.)

4168 CF-52-3-151
Oak Ridge National Lab., Tenn.
DISSOLVER OFF-GAS PROCESSING—QUARTERLY REPORT FOR PERIOD NOVEMBER 10, 1951 TO FEBRUARY 10, 1952. T. S. McMillan. Mar. 19, 1952. Decl. Dec. 21, 1955. 13p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Work was undertaken to relocate the gas train used for removal from the gas stream of components which would interfere with adsorption of Kr and Xe. Also undertaken was construction of an adsorber with a refrigeration system based on the use of liquid N under pressure. Unexpected difficulties in operation of the relocated gas train slowed experimental progress, but five adsorption tests were made. In the tests the gas mixtures containing Kr and Xe were passed through the adsorber and the concentration of Kr in the exhaust gas plotted as a function of time. It was established that the pattern of break-through closely followed theoretical considerations. Accordingly, rather precise predictions of the life of any such adsorber can be made provided concentration of the components in the inlet stream is known and a permissible value in the exhaust gas is established. Roughly speaking, with a contact time of 10 seconds, each gram of carbon in the adsorber will adsorb approximately 50 standard cubic centimeters of Kr and Xe from a gas containing in the range of one-half per cent of these elements before the efficiency of the adsorber drops below 95%. Considerable improvement in technique for determination of Kr concentration by counting Kr^{85} tracer was achieved during the quarter. A commercial type RCL counter-tube was substituted for the special, gas-purged, gold-plated-rubber-hydrochloride-window tube. This development increased the reliability of determinations and made it possible to establish a precise pattern for breakdown of the adsorber. A thermal decomposition procedure for decomposition of nitrous oxide has been developed. Essentially complete decomposition of nitrous oxide in a gas mixture was achieved by passing a gas mixture containing nitrous oxide through an Inconel pipe at 980°C with an exposure time of 7 seconds. (auth)

4169 CF-52-5-142
Oak Ridge National Lab., Tenn.
INSTRUMENTATION FOR EXTRACTION COLUMN INTERFACE CONTROL. P. E. Brown. May 16, 1952. Decl. Dec. 20, 1955. 12p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

During a visit to ORNL a group from Chalk River observed an extraction column interface controller. Specific questions concerning the controller are answered, and recommendations and discussion of various factors important to satisfactory column interface control are included. (C.H.)

4170 CF-54-2-179
Oak Ridge National Lab., Tenn.
REMOVAL OF COBALT CYANIDE COMPLEX FROM ANION RESIN. I. R. Higgins. Feb. 23, 1954. Decl. Dec. 20, 1955. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A major problem in the use of ion exchange resins for recovery of uranium from South African gold ore residue leach liquors has been poisoning of the resin by a cobalt cyanide complex which is not removed by the usual resin regeneration procedures. A method involving elution with 2 M ammonium thiocyanate followed by treatment with sodium hypochlorite has been developed for removal of the poison resulting in essentially complete restoration of the uranium sorption capacity of the resin at a reagent cost of about $21.80 per cubic foot of resin. New resin costs $70 per cubic foot. The treatment is described. (auth)

4171 CN-1205
[Clinton Labs., Oak Ridge, Tenn.]
CHEMICAL RESEARCH—DIRECT CONTRIBUTIONS TO PROCESS DECONTAMINATION AND ANALYSIS REPORT FOR THE MONTH ENDING JANUARY 11, 1944. Feb. 9, 1944. Decl. Dec. 13, 1955. 26p. (A-1685) $4.80(ph OTS); $2.70(mf OTS).

Progress is reported in the development of procedures for the radiochemical determination of fission products in the presence of $BiPO_4$. Data are presented on the

separation and determination of Ce. The field of separation process thermodynamics was explored with respect to $BiPO_4$ equilibria and LaF_3 equilibria. Several implications for the Bismuth Phosphate Separation Process are discussed. In both cases some experimental verification of theory is presented. Results are reported from experiments on the adsorption of Nb by MnO_2 and on the adsorption of Ru by $BiPO_4$. (C.H.)

4172 CN-1859

[Clinton Labs., Oak Ridge, Tenn.]

STUDIES IN ION EXCHANGE ADSORPTION: THE DYNAMICS OF PLUTONIUM (IV) ADSORPTION FROM AQUEOUS URANYL NITRATE SOLUTIONS. Problem Assignment No. 202-X28C. Final Report: Part II. A. W. Adamson. Apr. 19, 1945. Decl. Jan. 5, 1956. 81p. Contract W-7405-eng-39. (A-3043). $18.30(ph OTS); $6.00(mf OTS).

A detailed study of the adsorption of Pu(IV) in UNH solutions by an ion-exchange adsorbent, Amberlite IR-1, was made. The following results were obtained. The distribution coefficient, K_d, was found to be constant when the adsorption of Pu(IV) in 0.213M UNH was studied over a Pu concentration range of 32 mg/l to 8×10^{-5} mg/l. When the UNH concentration was changed, K_d obeyed the equation $K_d = 4.4 \times 10^{-4} (UO_2)^{-2}$ where (UO_2) is in moles per liter. This dependence is in agreement with the theoretical prediction. The rate of approach to equilibrium could be described quantitatively by an equation derived from a diffusion mechanism, but not by any chemical rate expression. Solutions to the diffusion equation are given both for slab-like and for spherical particles, and for either constant or variable concentration of adsorbate in the solution. When 0.2M UNH solution plus plutonium is flowed through a deep bed of IR-1, and a plot of effluent concentration against time is made, an S-shaped curve is obtained. These "breakthrough" curves were found to agree well with theory. The solutions, given by T.E.W. Schumann, are in the form of a set of theoretical curves which are matched with the experimental curve to obtain values of the mass action rate constant, k', and the distribution coefficient, K. Using the Schumann theory, the effect of varying the flow rate, bed depth, Pu concentration, UNH concentration, impurities, citric acid concentration, mesh size of adsorbent, column diameter, temperature, on k' and K are obtained. The effect of flow rate, bed depth and mesh size on k' are explainable by diffusion theory, whereas the effect of UNH concentration on k' and K is predictable by the mass action rate mechanism. No effect of Pu concentration, in 0.2M UNH solution, was found for the range 10 mg/l to 8×10^{-4} mg/l. A detailed discussion is made of the relation of column adsorption performance to the batch equilibrium and rate of adsorption data. (auth)

4173 CN-1872

[Clinton Labs., Oak Ridge, Tenn.]

STUDIES IN ION EXCHANGE ADSORPTION: EQUILIBRIA WITH Pu (IV), FISSION, AND OTHER CATIONS. Problem Assignment No. 202-X28C. Final Report: Part I. J. Schubert. Jan. 1, 1945. Decl. Jan. 4, 1956. 118p. Contract W-740[5]-eng-39. (A-3039). $18.30(ph OTS); $6.00(mf OTS).

The exchange adsorption of cations by the synthetic resin, Amberlite IR-1, was found to obey the law of mass action (a) when the activities of the solid phase components were expressed in terms of their mole fractions; (b) when the thermodynamic activities of the ions in the equilibrium solution were employed; and (c) when the anionic portion of the adsorbent, R, was taken as monovalent. Standard free energies of formation of several cation "salts" of IR-1 were calculated by the relation: $\Delta F^\circ = RT \ln K_a$. Some of the values for ΔF°_{298} were: NaR = −0.34; $\frac{1}{2}$ BaR_2 = −1.11; $\frac{1}{2}$ UO_2R_2 = −0.74 and $\frac{1}{3}$ LaR_3 = −0.9 kcal.; respectively, if the free energy of formation of HR is arbitrarily chosen as zero. The order of adsorption affinity for several cations on IR-1 from solutions of uranyl nitrate was found to be as follows: Th(IV) > Pu(IV) > La(III) Rare earths > Y(III) Rare earths > Ba(II) > Cs(I) > Sr(II) > UO_2^{++}. The ion exchange reaction was used also to determine the activity coefficients of salts present only in tracer quantities when dissolved in concentrated solutions of a foreign electrolyte. Furthermore, measurements of ion exchange equilibria were utilized in the detection and study of colloids, and it was found that under special conditions Zr, Cb and Pa may exhibit radiocolloidal behavior. Finally, it was shown that a knowledge of the quantitative values for the mass law distribution constants (K_a or K_c) was of practical use in predicting the concentrations of a micro-component at which its adsorption will diminish sharply, or, in calculating the change in adsorption of a trace ion with increase in the bulk ion concentration. (auth)

4174 CNL-34

Clinton National Lab., Oak Ridge, Tenn.

s-DIPHENYLTHIOUREA AS A COMPLEXING AGENT FOR RUTHENIUM. G. D. Calkins. Sept. 13, 1948. Decl. Dec. 20, 1955. 29p. Contract W-35-058-eng-71. $4.80(ph OTS); $2.70(mf OTS).

The use of s-diphenylthiourea to form an organic soluble complex with ruthenium is discussed. The stability of the complex in the presence of various reagents is examined. The effect of s-diphenylthiourea on U, Np, Nb, and Zr is indicated. Application of the complexing agent for decontamination in a countercurrent extraction process is discussed. (auth)

4175 HDC-852

Hanford Works, Richland, Wash.

GENERAL PRINCIPLES FOR DESIGN OF SPRAY AND PACKED COLUMNS. R. E. Tomlinson. Nov. 23, 1948. Decl. Jan. 11, 1956. 14p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

4176 IDO-16096

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

CALCULATIONS OF AMOUNT OF SILICON PRESENT IN A FUEL ASSEMBLY AFTER IRRADIATION IN THE MTR. D. W. Knight, D. P. Halls, and G. L. Smith. Apr. 10, 1953. Decl. Jan. 6, 1956. 9p. Contract AT(10-1)-205. $1.80 (ph OTS); $1.80(mf OTS).

The possibility of Si present in the MTR fuel assemblies causing difficulties in dissolving procedures initiated a study to determine how much Si could be encountered when dissolving the fuel assemblies. The net change in the Si content after irradiation was calculated by taking into account the amount of Si initially present as an impurity in the fuel assembly, the amount formed due to neutron capture by Al, and the amount of Si burned up due to irradiation. (J.S.R.)

4177 ISC-66
Iowa State Coll., Ames.
DECOMPOSITION OF MONAZITE—EFFECT OF A NUMBER OF VARIABLES ON THE DECOMPOSITION OF MONAZITE SAND WITH SULFURIC ACID. Theodore William Blickwedel. Nov. 12, 1949. Decl. Jan. 5, 1956. 28p. Contract W-7405-eng-82. $4.80(ph OTS); $2.70(mf OTS).

Studies were made on Indian monazite sand of the amount of perchloric acid needed for digestion; it was found that an acid/sand ratio (basis 100% $HClO_4$) of about 3.5/1 was required. For purposes of getting a soluble Th product, a ratio of H_2SO_4/sand (basis 100% H_2SO_4) of 2/1 has been reported. Since the cost of $HClO_4$ acid is much greater than H_2SO_4, it was concluded that the $HClO_4$ decomposition is not economically feasible at current conditions. Attention was turned toward the decomposition of monazite with H_2SO_4. Studies were made on the effect of temperature, acid/sand ratio (acidulation), acid concentration, and digestion time. Complete decomposition could be secured with ratios of H_2SO_4/sand as low as 2.5/1, 95% acid, and 200°C. It was also found that an insoluble compound of Th begins to form at digestion temperatures over 215°C. Of particular interest was the discovery that an acid concentration of 93% gives optimum decomposition under a given set of conditions. For the purpose of decomposing monazite to secure a solution from which thorium can be extracted, it is recommended that 93% sulfuric acid be used with a weight ratio of H_2SO_4/sand of 2.5/1 at 200°C. If the solution is to be heated or greatly diluted (as may prove necessary in liquid-liquid extraction), a higher ratio with subsequent excess acid will be necessary to prevent formation of a Th precipitate. Precipitation can be prevented by the addition of H_2SO_4 to the solution after the digestion and before dilution or heating. (auth)

4178 ISC-67
Iowa State Coll., Ames.
SOLVENT EXTRACTION OF AQUEOUS SOLUTIONS OF RARE EARTHS; SOLVENT EXTRACTION OF THORIUM AND RARE EARTHS FROM AQUEOUS SOLUTION OF MONAZITE SAND DECOMPOSED WITH SULPHURIC ACID. Max L. Feldman. Sept. 28, 1949. Decl. Jan. 5, 1956. 27p. Contract [W-7405-eng-82]. $4.80(ph OTS); $2.70(mf OTS).

A study was made of the stability of solutions of monazite sand decomposed with varying ratios of H_2SO_4 to sand in order to determine the effects of temperature, dilution, and heating after dilution on these solutions. A synthetic solution to correspond to a solution of monazite decomposed with a ratio of acid to sand that gives a stable solution was prepared. Ce was used in this solution to represent all the rare earths. The synthetic solution was then extracted with a series of solvents as part of a solvent search. Following the solvent search, a set of extractions were made using a solution of decomposed monazite sand and nitromethane. This was followed by another set of extractions wherein the monazite sand solution was extracted with mixtures of n-butyl alcohol and dioxane, n-butyl alcohol and 95% ethyl alcohol, and n-butyl alcohol and ethylene glycol monomethyl ether. It was concluded that no one of the solvents tried would extract. It was also concluded that the mixtures of n-butyl alcohol with dioxane, 95% ethyl alcohol, and ethylene glycol monomethyl ether would extract the metal salts, but that they were impractical solvents because repeated extractions caused the formation of a precipitate in the raffinate layer. Finally, it was concluded that the Th could not be extracted selectively stripped with water from the extract layers of the butyl alcohol extractions. (auth)

4179 ISC-85
Ames Lab., Ames, Iowa.
PREPARATION OF PURE ZIRCONIUM OXIDE BY THE AMES PROCESS. Summary Report. R. S. Hansen. May 15, 1950. Decl. Jan. 6, 1956. 25p. Contract [W-7405-eng-82]. $4.80(ph OTS); $2.70(mf OTS).

In the Ames process the Hf is removed from the mixed Hf and Zr tetrachlorides in methanol solution, by preferential adsorption on silica gel. The methanol is distilled from the effluent; the residue is dissolved in water, HCl is added, and the resulting Zr oxychloride is separated from other common impurities by crystallization of the oxychloride. Conversion of the oxychloride to the oxide is accomplished by ignition. Operations at small pilot plant level and proposed operations on larger scale are discussed. The Ames process appears to be capable of competing economically with any other process heretofore proposed, and of meeting arbitrary specifications both with respect to Hf content and other common impurities. The process also permits wide choice of final product to meet metallurgical requirements. (auth)

4180 ISC-100
Iowa State Coll., Ames.
CONCENTRATION OF RADIOACTIVE CONSTITUENTS IN RESIDUAL MATERIALS. Samuel William Vance. [1950]. Decl. Jan. 5, 1956. 26p. $4.80(ph OTS); $2.70(mf OTS).

In the Ames process of producing metallic Th, the slag, consisting mostly of CaF_2, $CaCl_2$, and dolomitic oxide, contains some residual ThF_4 from the reduction bomb. The object was to investigate the concentration and recovery of the U in the slag by physical methods. Previous work on the problem was reported using HCl and NaOH. However, this method did not extract Th from the present slag. The effect of dry grinding and water disintegration on concentration of Th in screened fractions and density fractions was determined. Exploratory flotation tests were made. A very slight concentration of the Th was effected by water leaching of the sample. None of these tests showed sufficient concentration to be of practical importance. The concentration of Th can be nearly doubled by treating the slag with HCl, which neutralizes and dissolves the Ca and Mg oxides present. Further treatment of the concentrate would then consist of digestion by perchloric or sulfuric acid. (auth)

4181 K-446
Carbide and Carbon Chemicals Corp. K-25 Plant, Oak Ridge, Tenn.
ION EXCHANGE EQUILIBRIA. EXCHANGE OF COBALT-AMINE COMPLEX IONS. H. L. Bench, H. B. Weisblatt, and R. H. Winget. July 20, 1949. Decl. Dec. 27, 1955. 10p. Contract [W-7405-eng-26]. (KLO-128). $1.80(ph OTS); $1.80(mf OTS).

In the equilibrium exchange of Nalcite HCR (Dowex 50) synthetic ion exchange resin with complex cobaltic cations having approximately the same ionic radius and a positive charge of 1, 2, and 3, respectively, ion radius is the predominant factor influencing the exchange capacity and variation of ionic charge has little or no effect on the exchange. The average number of millimols exchanged with one gram of resin is 1.30 for the ion with a triple charge, 1.45 for the ion with charge two, and 1.35 for the univalent ion. (auth)

4182 K-556
Carbide and Carbon Chemicals Corp. K-25 Plant, Oak Ridge, Tenn.
SLUDGE FORMATION IN SYNTHETIC METAL WASTE AT 90°C. J. C. Barton, R. H. Rainey, and W. R. Rossmassler, Jr. Jan. 25, 1950. Decl. Dec. 27, 1955. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Prior to the withdrawal of samples of uranium sludge from the bismuth phosphate process waste at Hanford, an experiment was performed which furnished certain information regarding the rate of formation and nature of the sludge and the relative amount of uranium which it contained. Simulated metal waste solution was placed in a mild steel vessel and held at 90°C under reflux for thirty-one days. Samples which were removed at appropriate intervals showed that approximately 76% of the uranium precipitated during the first day. After thirty days 8% of the uranium remained in solution, 65% existed as a water-soluble precipitate, and 27% was in the form of a water-insoluble precipitate. (auth)

4183 K-570
Carbide and Carbon Chemicals Div. K-25 Plant, Oak Ridge, Tenn.
REMOVAL OF RUTHENIUM FROM WASTE. G. A. Eaton, J. J. Finley, H. G. Hunter, F. Mills, and R. W. Vogel. Feb. 22, 1950. Decl. Jan. 6, 1956. 18p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

Several insoluble compounds have been investigated as scavengers for removing radioactive Pu from solution. None were adequate from the standpoint of decontamination. The removal of Ru from solution by distillation of the tetroxide is much more promising. Although optimum conditions for this operation have not been established, 85 to 99% removal of Ru was effected by using strong oxidants such as Cl_2, O_3, $KMnO_4$, and $NaBiO_3$. Chlorine was most effective in alkaline solution, ozone in the pH range of about 3 to 10, and permanganate and bismuthate at still lower pH values. The distillation of RuO_4 can be used as a method to separate Ru from other fission-product radioisotopes which exist in aged metal waste. (auth)

4184 KAPL-612
Knolls Atomic Power Lab., Schenectady, N. Y.
INTERIM REPORT ON COLD TRAP INVESTIGATIONS. B. G. Voorhees and W. H. Bruggeman. Oct. 1, 1951. Decl. Jan. 5, 1956. 36p. Contract W-31-109-eng-52. $4.80 (ph OTS); $2.70(mf OTS).

Recent tests of cold trapping have demonstrated the feasibility of this method for the removal of sodium oxide from sodium in a circulating system. A summary of work to date is presented with a description of test equipment, test procedures, and test results. Operating theories are discussed, and a brief outline of future development work is included. (auth)

4185 ORNL-40
Oak Ridge National Lab., Tenn.
REACTION OF NITRIC ACID WITH DIISOPROPYL KETONE; PREPARATION AND IDENTIFICATION OF 2-NITRO 2, 4-DIMETHYL PENTANONE-3. Final Report. M. R. Poston. May 3, 1948. Decl. Jan. 6, 1956. 20p. Contract [W-7405-eng-26]. Charge $3.30(ph OTS); $2.40(mf OTS).

4186 ORNL-41
Oak Ridge National Lab., Tenn.
THE EFFECT OF COLUMN VARIABLES ON ELUTION. E. R. Tompkins, D. H. Harris, and J. X. Khym. May 7, 1948. Decl. Jan. 6, 1956. 29p. Contract W-35-058-eng-71. $4.80(ph OTS); $2.70(mf OTS).

The effects of several variables on the efficiency of ion exchange columns for the separation and purification of fission products were studied. Results are presented graphically and in tabular form. (auth)

4187 ORNL-96
Oak Ridge National Lab., Tenn.
LIMITING FLOW RATED IN CONTINUOUS COUNTER-CURRENT EXTRACTION COLUMNS. Final Report. J. B. Ruch. July 15, 1948. Decl. Jan. 7, 1956. 18p. $3.30(ph OTS); $2.40(mf OTS).

Limiting flow (flooding) rates in continuous liquid-liquid countercurrent extraction columns were investigated for hexone and dibutyl cellosolve solvents, with aqueous $Al(NO_3)_3$ concentrations of 1.0 and 2.0M. (auth)

4188 ORNL-105
Oak Ridge National Lab., Tenn.
CHELATE PROCESS FOR ISOLATING ZIRCONIUM. Period Covered: December 1947 To April 1948. T. C. Runion. May 26, 1948. Decl. Jan. 6, 1956. 26p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

A process is presented for the isolation of radioactive Zr from solutions of Pu, U, and fission products based on extraction with thenoyltrifluoroacetone (TTA) in benzene. (auth)

4189 ORNL-239
Oak Ridge National Lab., Tenn.
CHEMISTRY OF PROTACTINIUM. II. SOME OBSERVATIONS ON THE SOLVENT EXTRACTION OF PROTACTINIUM. Kurt A. Kraus and Quentin Van Winkle. Feb. 17, 1949. Decl. Jan. 6, 1956. 13p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

Protactinium was found to be extractable from HCl solutions by organic solvents (diisopropyl ketone). Addition of peroxide or oxalate decreases the extractability. However, even in the presence of these complexing agents, good extraction can be obtained if the acid concentration is sufficiently high. (auth)

4190 ORNL-275
Oak Ridge National Lab., Tenn.
THE PREPARATION OF Ru-106 TRACER FROM WASTE METAL SOLUTION. A. T. Gresky. July 22, 1949. Decl. Jan. 6, 1956. 14p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

A process is presented for the recovery of 290 day Ru^{106} from waste metal solutions. This process is based on the carrying of ruthenium on $Fe(OH)_2$ and subsequent distillation from $KMnO_4-H_2SO_4$. (auth)

4191 ORNL-1310
Oak Ridge National Lab., Tenn.
A COUNTERCURRENT SOLID-LIQUID CONTACTOR FOR CONTINUOUS ION EXCHANGE. I. R. Higgins. Sept. 19, 1952. Decl. Jan. 5, 1956. 18p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

A continuous countercurrent solid-liquid contactor has been developed which retains the desirable features of the conventional fixed bed and gains the advantages of countercurrent flow. It can be adapted to many solid-liquid mass-transfer processes such as ion exchange, silica gel adsorption, and ore leaching. (auth)

4192 RMO-2701
Tennessee Valley Authority, Wilson Dam, Ala.
UTILIZATION OF FLORIDA LEACH ZONE MATERIAL. PROGRESS REPORT [FOR] DECEMBER 1951 TO APRIL 30, 1952. May 27, 1952. Decl. Nov. 28, 1955. 68p. (TVA-1). $10.80(ph OTS); $3.90(mf OTS).

Samples of Florida leached zone material were beneficiated by various ore dressing methods for subsequent extraction of U, P and Al. Direct chlorination of beneficiated material resulted in volatilization of most of the U together with the Fe, less than half of the Al, and a small part of the P. Al_2O_3 was separated by extraction with dilute solution of Na_2CO_3. Methods were considered for processing aluminiferous phosphate for the purpose of recovery of its Al and P contents in commercially valuable form. (T.W.S.)

4193 RMO-2702
Tennessee Valley Authority, Wilson Dam, Ala.
UTILIZATION OF FLORIDA LEACH ZONE MATERIAL. PROGRESS REPORT [FOR] MAY 1952. June 10, 1952. Decl. Nov. 28, 1955. 12p. (TVA-2). $3.30(ph OTS); $2.40(mf OTS).

Samples of low-grade leach-zone material were beneficiated by washing, sizing, and attrition grinding. Half of the phosphate was recovered with an enrichment ratio greater than 2 and 85% recovered with an enrichment ratio of 1.6. Direct chlorination of the leach-zone material concentrates resulted in the volatilization of 90% of the U and 50% of the Al_2O_3. Most of the P_2O_5 remained in the residue. H_2SO_4 extraction of wavellite with a H_2SO_4/wavellite weight ratio of 0.35 yielded 80% of the U, 90% of the P_2O_5, and 40% of the Al_2O_3. (T.W.S.)

4194 RMO-2703
Tennessee Valley Authority, Wilson Dam, Ala.
UTILIZATION OF FLORIDA LEACH ZONE MATERIAL. PROGRESS REPORT [FOR] JUNE 1952. July 10, 1952. Decl. Nov. 28, 1955. 16p. $3.30(ph OTS); $2.40(mf OTS).

Four prospect samples of leach zone material were analyzed for P_2O_5, Al_2O_3, Fe_2O_3, and U and given preliminary beneficiation tests. Studies are reported on recovery of U, P_2O_5, and Al_2O_3 from concentrates of leach zone material by high-temperature chlorination. H_2SO_4 extraction tests were made using samples of leach zone containing more CaO and less Al_2O_3 than test previously reported. Nitric acid extraction of U, P_2O_5, and Al_2O_3 is reported. (L.M.T.)

4195 RMO-2704
Tennessee Valley Authority, Wilson Dam, Ala.
UTILIZATION OF FLORIDA LEACH ZONE MATERIAL. PROGRESS REPORT [FOR] JULY 1952. Aug. 5, 1952. Decl. Nov. 28, 1955. 15p. $3.30(ph OTS); $2.40(mf OTS).

Maximum P_2O_5 recovery and enrichment ratios are reported on preliminary beneficiation tests of Florida leached zone material from the Virginia-Carolina Chemical Corporation. Uranium recovery by direct chlorination and by extraction with H_2SO_4 or HNO_3 is reported. A comparison is made between the chlorinating selectivity of HCl and Cl_2. (L.M.T.)

4196 RMO-2705
Tennessee Valley Authority, Wilson Dam, Ala.
UTILIZATION OF FLORIDA LEACH ZONE MATERIAL. PROGRESS REPORT [FOR] AUGUST 1952. Sept. 15, 1952. Decl. Nov. 28, 1955. 10p. (TVA-5). $1.80(ph OTS); $1.80(mf OTS).

Progress is reported on the following: extraction of high alumina phosphate with H_2SO_4 or HNO_3, preparation of superphosphate-type fertilizers, preparation of nitric phosphate-type fertilizers, hygroscopicity tests, and direct chlorination of high-alumina phosphates. (L.M.T.)

4197 RMO-2706
Tennessee Valley Authority, Wilson Dam, Ala.
UTILIZATION OF FLORIDA LEACH ZONE MATERIAL. PROGRESS REPORT [FOR] SEPTEMBER 1952. Oct. 16, 1952. Decl. Nov. 28, 1955. 20p. $3.30(ph OTS); $2.40 (mf OTS).

Studies of mechanical beneficiation of leach-zone material by wet and dry methods are reported. Exploratory studies are reported on processes for producing a nitric phosphate fertilizer (nitric acid process) and a superphosphate-type fertilizer (sulfuric acid process) from Florida leach-zone material. The electrolysis of trisodium phosphate in a small cell in which the electrode compartment were separated by a cation exchange membrane was tested. Other laboratory tests included a final chlorination of leach-zone concentrate with a mixture of Cl and HCl and treatment of leach-zone concentrate with SO_2, concentrated phosphoric acids, alkali and alkaline earth compounds, and $(NH_4)_2SO_4$. (L.M.T.)

Refer also to abstracts 4219, 4251, and 4252.

TRANSURANIC ELEMENTS AND COMPOUNDS

4198 AECD-3887
Knolls Atomic Power Lab., Schenectady, N. Y.
COULOMETRIC TITRATION OF PLUTONIUM. A. B. Dreeben. Feb. 17, 1953. Decl. with deletions Jan. 5, 1956. 15p. Contract W-31-109-eng-52. $3.30(ph OTS); $2.40(mf OTS).

A method is described for the electroreduction of Pu^{+6} to Pu^{+3} in a nitric acid-sulfamic solution. Exploratory experiments in the search for a coulometric titration of Pu^{+3} using electrolytically generated Ce^{+4} are also described. (auth)

4199 AECD-3938
[Knolls Atomic Power Lab., Schenectady, N. Y.]
RADIOCHEMISTRY III. Nuclear Engineering Course, 1947–1948. E. Zebroski. Apr. 15, 1948. Decl. with deletions Jan. 9, 1956. 16p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

The radiochemistry, including complex ion formation, and reactor applications of the actinide elements are discussed. (C.W.H.)

4200 CH-3578
Chicago. Univ. Metallurgical Lab.
STUDIES ON PU(IV) SOLUTIONS IN THE PRESENCE AND ABSENCE OF CITRIC ACID. Jack Schubert and David Revinson. June 20, 1946. Decl. Jan. 5, 1956. 24p. Contract W-7401-eng-37. $4.80(ph OTS); $2.70(mf OTS).

The techniques of low pressure ultrafiltration and ion exchange were employed in a study of the nature of Pu^{4+} (at tracer concentrations $\sim 10^{-7}$M) in protein-free isotonic solutions. Additionally, the stability of the complex formed between Pu^{4+} and citric acid was investigated over a wide pH range. It was found that Pu^{4+} underwent an abrupt change to a radiocolloidal behaving state above a pH of 2.6. Below a pH = 2.6 the diffusibility of Pu was nearly complete but dropped very rapidly and at a pH of 3.7 a fraction of Pu which was diffusible had become con-

stant at 50 per cent. A corresponding increase in the amount of Pu^{4+} which was adsorbed on the sac membrane took place. The addition of a small amount of citric acid (< 0.005M) rendered the plutonium completely diffusible and reduced the Pu adsorbed on the membrane surfaces to an inappreciable amount. As little as 3×10^{-5}M citric acid at a pH = 7.4 caused a marked increase in the diffusibility of plutonium. About 50% of Pu^{4+} was complexed at a pH = 2.0 in 0.05M citric acid. The corresponding pH values at which 50% complexing occurs for La^{3+} and Ba^{2+} were indicated to be at pH's of about 3 and 4, respectively. Hence the strengths of the metal-citric acid complex are in the order $Pu^{4+} > La^{3+} > Ba^{2+}$. Below a concentration of 0.02M citric acid the rate of solubilization of the colloidal-like Pu was time dependent. Above 0.03M citric acid the complexing action was independent of the time for solutions which had stood for at least one day in contact with citric acid. The complexing action of citric acid on Pu^{4+} began to manifest itself (in 0.05M citric acid) at a pH = 1.2 and appeared to be completed at a pH of 3.0. Only 50% of the Pu in a specimen of human urine was found to be diffusible. The fraction of diffusible Pu in blood was much less. (auth)

4201 CK-1803

California. Univ., Berkeley. Radiation Lab.

THE DISTRIBUTION OF PLUTONIUM TRACER BETWEEN METALS AND THEIR MOLTEN HALIDES. VIII. DISTRIBUTION OF PLUTONIUM TRACER IN THE CERIUM–CERIUM BROMIDE SYSTEM. B. J. Fontana. June 14, 1944. Decl. Jan. 4, 1956. 5p. (A-2631; MB-169). $1.80 (ph OTS); $1.80(mf OTS).

The resemblance in certain respects of Pu to the rare earths, especially Nd, makes it of some interest to extend the studies of the high temperature oxidation-reduction relations of Pu tracer in metal-metal halide systems to one of the rare-earths. This has been done with Ce. Four experiments at 790° to 800°C in Mo crucibles were performed using Ce and $CeBr_3$. The same equilibrium state was attained regardless of the method of introduction of the tracer. The best average value of the equilibrium constant, K, is approximately 0.3. This value may be slightly low because of the presence of Fe impurity in the Ce metal used. The Ce–$CeBr_3$ couple then appears to be somewhat more electropositive than the corresponding Pu couple. The composition of the salt phase after equilibration with the metal corresponded closely to $CeBr_2$. (auth)

4202 CN-2216

Clinton Labs., Oak Ridge, Tenn.

INVESTIGATIONS OF THE CHEMISTRY OF PLUTONIUM. PRELIMINARY STUDIES OF PLUTONIUM IN ALKALINE SOLUTIONS. Progress Report–P. A. No. 213-X40C. G. E. Moore and J. R. Dem. May 2, 1945. Decl. Dec. 15, 1955. 10p. Contract W-7405-eng-39. $3.30(ph OTS); $2.40(mf OTS).

The absorption spectra of Pu(IV) and Pu(VI) in 45% K K_2CO_3 indicate that both ions are complexed by $CO_3^=$. The prominent infrared peak of Pu(VI) which is found in acid solutions has been almost entirely quenched in these solutions. In 45% K_2CO_3 Pu(VI) was reduced by $SO_3^=$, $S^=$, Cu_2O, and H_2O_2 but not by NO_2^-. Reduction of Pu(VI) by $SO_3^=$ probably yielded Pu(V) while reduction by the other reducing agents yielded Pu(IV). Oxidation of Pu(IV) to Pu(VI) in 45% K_2CO_3 was achieved with Ag_2O, MnO_4^-, and ClO^- but not with $SeO_4^=$, Hg_2O, IO_3^-, H_2O_2, O_3 or oxygen. NaOCl readily oxidizes $Pu(OH)_4$ in 5M NaOH at 85°C. Spectral curves for Pu(IV) in oxalate and acetate solutions indicate complexing of Pu(IV) by both acetate and $C_2O_4^=$. (auth)

4203 CN-3399

[Clinton Labs., Oak Ridge, Tenn.]

STUDIES ON POLYMERIC Pu(IV); DEPOLYMERIZATION OF POLYMERIC Pu(IV) SOLUTIONS IN NITRIC ACID. K. A. Kraus. June 30, 1945. Decl. Dec. 14, 1955. 25p. Contract W-7405-eng-39. $4.80(ph OTS); $2.70(mf OTS).

The rates of depolymerization were studied under a variety of conditions, and it was found that in general depolymerization follows a first order law. Some observations regarding "incipient precipitation" of polymeric solutions are described. General aspects of the spectrophotometric analysis of two-component systems are discussed. (auth)

4204 CUD-92

Columbia Univ., New York.

SLOW NEUTRON VELOCITY SPECTROMETER TRANSMISSION STUDIES OF Pu. W. W. Havens, Jr., E. Melkonian, L. J. Rainwater, and M. Levin. May 28, 1951. Decl. Dec. 20, 1955. 27p. Contract AT-30-1-Gen-72. (DR-1658). $6.30(ph OTS); $3.00(mf OTS).

A number of resonances in Pu were studied in the region of 0 to 6 ev. Less precise measurements were made above 6 ev. (K.S.)

4205 HW-30384

Hanford Atomic Products Operation, Richland, Wash.

A STUDY OF PLUTONIUM TRIFLUORIDE PRECIPITATED FROM AQUEOUS SOLUTION. Miriam M. Jones. Dec. 28, 1953. Decl. Jan. 6, 1956. 15p. Contract W-31-109-eng-52. $3.30(ph OTS); $2.40(mf OTS).

Plutonium trifluoride precipitated from aqueous solution and dried at room temperature is of sufficiently reproducible composition to serve as a primary Pu standard. On the basis of a limited number of analyses, preparations made by the most suitable technique were found to have a Pu content of 78.5 ± 0.2%(σ_x). The trifluoride, when dried at room temperature, has a H_2O content of 2.3 ± 0.3%(σ_x) corresponding to the formula $PuF_3 \cdot 0.40\ H_2O$. The material undergoes slow hydrolysis to the oxide, but the composition can be considered constant for at least 7 weeks. When dried at 200°C in vacuum, it loses weight but becomes hygroscopic so that the loss is regained on standing in air. From the standpoint of ease of preparation and dissolution, the trifluoride appears to be satisfactory as a Pu standard. Concentrations up to 15 g/l of Pu in 2N HNO_3 are readily prepared, and higher concentrations are attainable. The PuO_2 formed by ignition of the trifluoride, while requiring an extra preparation step, has some advantages over the trifluoride as a Pu standard in that it dissolves more easily, should be stable indefinitely, and has a definite and easily reproducible composition. (auth)

4206 HW-34162

Hanford Works, Richland, Wash.

THE FISSION CROSS SECTION f FACTOR OF Pu^{239}. G. W. Stuart. Dec. 16, 1954. Decl. Jan. 7, 1956. 2p. Contract [W-31-109-eng-52]. $1.80(ph OTS); $1.80(mf OTS).

4207 HW-34431

Hanford Atomic Products Operation, Richland, Wash.

THE ALPHA HALF-LIFE OF THE ISOTOPE Pu^{241}. M. W. Gift. Feb. 15, 1955. Decl. Jan. 6, 1956. 10p. Contract W-31-109-eng-52. $1.80(ph OTS); $1.80(mf OTS).

A Pu solution of known Pu^{241} content was purified by

solvent extraction techniques to remove U and Am impurities. Portions of this purified solution were then analyzed for U^{237} as a function of time. Since the growth of U^{237} occurs directly by the α decay of Pu^{241}, these measurements provided sufficient data for calculation of the Pu^{241} α half life, which was found to be $2.91 \pm 0.50 \times 10^5$ years. (auth)

Refer also to abstracts 4144 and 4471.

URANIUM AND URANIUM COMPOUNDS

4208 A-132

[National Bureau of Standards, Washington, D. C.] THE PREPARATION OF URANYL ACETATE FOR MAKING FILMS IN α-COUNTING WORK. James I. Hoffman and Clement J. Rodden. Mar. 27, 1942. Decl. Jan. 13, 1956. 6p. $1.80(ph OTS); $1.80(mf OTS).

The primary considerations in the preparation of uranyl acetate for α-counting films are briefly discussed. These include the conditions that the U_3O_8 formed on ignition of the acetate must be at least 99.9% pure, and that the preparation must have no constituents that will distrub the continuity of the film when the acetate is ignited. Purification methods are described in greater detail. (B.J.H.)

4209 A-193

National Bureau of Standards, Washington, D. C. PREPARATION OF URANIC OXIDE OF HIGH PURITY. Harry Matheson and Harold R. Mullin. June 19, 1942. Decl. Jan. 13, 1956. 9p. $1.80(ph OTS); $1.80(mf OTS).

The use of H_2O_2 as a precipitating agent in the preparation of UO_3 provides a means of converting $UO_2(NO_3)_2$ to the oxide which is capable of yielding a product of higher purity and in a more satisfactory physical condition than does the thermal decomposition of the nitrate. With samples of a few grams or less, the method is very satisfactory though not quantitative. The solubility of UO_4 in distilled water appears to be very slight but becomes appreciable as the pH increases. The method has one serious disadvantage: when working with samples of the order of 100 g, the precipitate is difficult to wash and filters slowly. Filterability may be improved by altering the conditions, i.e., the concentration of U, acid, and H_2O_2. Attempts to precipitate the peroxide from hot solution do not seem promising because of decomposition both of UO_4 and H_2O_2. (auth)

4210 A-2300

Brown Univ., Providence. [Metcalf Research Lab.] PREPARATION OF RO_3 AND R_3O_8 FROM $(NH_4)_2R_2O_7$-REACTION OF THE OXIDES WITH CCl_4 IN THE LIQUID PHASE. Charles A. Kraus. Oct. 5, 1944. Decl. Dec. 14, 1955. 5p. Contract W-7405-eng-73. (BT-39). $1.80(ph OTS); $1.80(mf OTS).

Under the proper conditions, $(NH_4)_2U_2O_7$ may be calcined to a reddish-colored oxide, which, on treating with H_2O, releases oxygen and is converted to hydrated UO_3. After calcination, this UO_3 has a bulk density of approximately 1.4 g./cc; it does not react quite as readily with CCl_4 in the liquid phase as the UO_3 prepared from UO_4. U_3O_8 prepared either by calcining $(NH_4)_2U_2O_7$ or UO_4 may be reacted with CCl_4 in the liquid phase to yield a good quality UCl_5. The chlorination reaction proceeds as rapidly or even more rapidly than it does with active UO_3 (from UO_4) and, other conditions being the same, the operating pressures are lower. A moderate amount of Fe as impurity in the oxide does not influence the reaction. (auth)

4211 A-2329(Pts. III and IV)

Brown Univ., Providence. Metcalf Research Lab. INVESTIGATIONS RELATING TO THE CHEMISTRY OF URANIUM. PART III. PREPARATION AND PROPERTIES OF URANIUM POLY- AND OXYCHLORIDES. Period covered: October 1, 1942–February 1, 1946. PART IV. INVESTIGATION OF CERAMIC MATERIALS AND THE PREPARATION OF URANIUM METAL. Period covered: September 1, 1942–August 15, 1944. Charles Evers and Charles A. Kraus. May 1, 1946. Decl. Dec. 2, 1955. 239p. (BT-68(Pts. III and IV)). $36.30(ph OTS); $10.20 (mf OTS).

Preparation and Properties of Uranium Poly- and Oxychlorides. Progress is reported in studies on the preparation and properties of U poly- and oxychlorides. Data are presented from a survey of analytical methods for evaluating the quality of polychloride products; the liquid phase chlorination reaction; the production of UCl_4 employing liquid phase chlorination of active UO_3 by CCl_4; the preparation of UCl_4 by vapor phase chlorination of UO_2 formed by reducing active UO_3 with ethanol; investigation of factors in the precipitation and thermal decomposition of UO_4 which influence the state of the resulting oxide; the preparation of UCl_6; the preparation of UCl_5 and two anhydrous oxychlorides, UO_2Cl_2 and $UOCl_2$; the reaction of H_2O vapor and liquid anhydrous HF with U poly- and oxychlorides; and the preparation of UF_4 by reaction of U oxides with freon reagents. Investigation of Ceramic Materials and the Preparation of Uranium Metal. Crucibles were prepared and tested for the production of U metal by the reduction of U chlorides or other halides. Details of methods used in producing the crucibles and for carrying out the reductions are described. (C.H.)

4212 A-2704

Purdue Univ., Lafayette, Ind. THE IDENTIFICATION OF THE BY-PRODUCTS FROM THE REACTION OF TUBALLOY TRIOXIDE WITH HEXACHLOROPROPENE. Summary Report. E. T. McBee and L. R. Evans. Dec. 14, 1945. Decl. Dec. 8, 1955. 20p. Contract W-7405-eng-74. $4.80(ph OTS); $2.70(mf OTS).

4213 A-3205

Carbide and Carbon Chemicals Corp. Substitute Alloy Materials Labs., New York. THE COLORIMETRIC DETERMINATION OF TUBALLOY [URANIUM] WITH SODIUM ALIZARINSULFONATE. E. V. Sayre and A. M. Mitchell. Feb. 26, 1945. Decl. Jan. 6, 1956. 11p. (EN-R-16). $3.30(ph OTS); $2.40(mf OTS).

The intense red color produced upon the addition of Na alizarinsulfonate to the U^{4+} ion in solutions as acid as pH 2.2 has been used for the quantitative determination of trace amounts of U. A simple, quantitative method for the reduction of UO_2^{2+} to U^{4+} is described. The interference of diverse ions was studied, and a workable method of separation from them established. (auth)

4214 AECD-3853

Tennessee Eastman Corp., Oak Ridge, Tenn. DEPARTMENT 192 PROGRESS REPORT [FOR] MONTH ENDING FEBRUARY 26, 1945. Summary of Experimental Work. E. F. Orlemann. Contract [W-7401-eng-23]. (CD-2228). $6.30(ph OTS); $3.00(mf OTS).

4215 AECD-3888

Carbide and Carbon Chemicals Corp. K-25 Plant, Oak Ridge, Tenn.

PRECISION OF THE PHOTOGRAPHIC SPECTROCHEMICAL ASSAY OF URANIUM 235 AT LOW CONCENTRATIONS. T. Lee, A. L. Hallowell, and Lewis H. Rogers. Mar. 20, 1951. Decl. with deletions Jan. 6, 1956. 19p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

A series of experiments was carried out to determine the precision of the spectrochemical procedure for the isotopic analysis of U, especially at low U^{235} concentrations. Standards were prepared from UF_6 which had been assayed on the mass spectrometer with a 95% confidence interval of 0.5% of the amount present. For a determination consisting of 9 separate measurements, the best precision obtained at normal concentration on the 95% confidence interval was 0.711 ± 0.112 per cent U^{235} (16% of the amount present). (auth)

4216 AECD-3907

Carbide and Carbon Chemicals Corp. Y-12 Plant, Oak Ridge, Tenn.

FACTORS AFFECTING THE PENTAETHER EXTRACTION OF URANIUM. D. F. Musser. July 25, 1947. Decl. Dec. 12, 1955. 50p. Contract W-7405-eng-26. (B-4.380.223). $7.80(ph OTS); $3.30(mf OTS).

The theoretical basis for extraction procedures is briefly discussed. Practical considerations involving extraction of U from a nitrate solution with pentaether and from pentaether with a solution of ammonium sulfate are given, together with supporting data. The distribution coefficients of a considerable number of elements are tabulated. The main sources of interference in the determination of U are discussed and, where possible, means for avoiding the interference are given. The standard pentaether extraction method is outlined. (auth)

4217 AECD-3919

Clinton Engineer Works, Oak Ridge, Tenn.

THE DETERMINATION OF T [U] AT THE DROPPING MERCURY ELECTRODE IN HEX [UF_6] PLANT AMMONIA AND PEROXIDE DECANTRATES. S. Kwiatkowski, J. Owens, and C. Casto. Jan. 16, 1945. Decl. Dec. 14, 1955. 11p. Contract W-7401-eng-23. (CD-ChemS-564). $3.30 (ph OTS); $2.40(mf OTS).

A polarographic method has been developed for the determination of small amounts of U in ammonia and peroxide filtrates from the UF_6 process and is intended for filtrates in which the U concentration is between 1 and 50 mg/l. Accuracy varies from about ±30% at concentrations approaching one mg/l to about ±2% at higher U concentrations. The UO_2^{2+} is determined in an aqueous H_2SO_4 solution (4% by volume) containing hydroxylamine sulfate. Very small amounts of Cu can be tolerated. Iron must be reduced. Other interferences are considered. (auth)

4218 AECD-3933

Tennessee Eastman Corp., Oak Ridge, Tenn.

THE PREPARATION OF TCl_4 [UCl_4] WITH HEXACHLOROPROPYLENE. B. M. Pitt, W. F. Curran, J. M. Schmitt, E. L. Wagner, and A. J. Miller. July 27, 1945. Decl. Dec. 21, 1955. 25p. Contract W-7401-eng-23. (C-2.350.3). $4.80(ph OTS); $2.70(mf OTS).

Simple and rapid methods for the preparation of UCl_4 by the reaction of hexachloropropylene with UO_3, U_3O_8, or wet peroxide cake are described. The UCl_4 prepared with hexachloropropylene is 98 to 100% pure and has a fine crystalline or granular appearance. (C.W.H.)

4219 AECD-3936

Tennessee Eastman Corp., Oak Ridge, Tenn.

FACTORS AFFECTING THE EXTRACTION OF URANIUM WITH DIBUTYL CARBITOL. Boyd S. Weaver. July 8, 1946. Decl Dec. 21, 1955. 52p. Contract W-7401-eng-23. (C-0.365.1). $9.30(ph OTS); $3.60(mf OTS).

The optimum conditions for the extraction of U by carbitol from aqueous solutions are shown to be high NO_3^- concentration, low acidity and low temperature. Phosphate ion and high concentrations of SO_4^{2-} and Cl^- are detrimental. Fluoride ion interferes when present in concentrations greater than 1%, but this interference can be overcome by the use of $Al(NO_3)_3$. Uranium concentration has little effect in the range between 0.5 and 5%. Iron is also extracted to a considerable extent, especially from solutions containing much Cl^-. Most elements other than Fe and B are extracted only slightly if at all, and special conditions can usually be applied to prevent or decrease extraction of any impurity. For removal of U from carbitol the optimum conditions are low NO_3^- concentration and high temperature. Uranium can be separated from Fe in carbitol by extraction with concentrated Cl^- solutions. (auth)

4220 AECD-3946

Tennessee Eastman Corp., Oak Ridge, Tenn.

TUBALLOY PEROXIDE [UO_4]. PART IV. THE EFFECT OF THE COMMON METAL IONS ON PRECIPITATION OF TUBALLOY PEROXIDE [UO_4]. P. F. Grieger, E. W. Christopherson, D. W. Mogg, and J. W. Gates, Jr. June 9, 1949. Decl. Dec. 22, 1955. 15p. Contract W-7401-eng-23. (CD-4033: XAC-R-666). $3.30(ph OTS); $2.40(mf OTS).

Iron, potassium, and alkaline earth metals interfere with the precipitation of UO_4 from uranyl nitrate solutions. Chloride ion delays the precipitation slightly; acetate is without effect. (C.W.H.)

4221 AECD-3950

Tennessee Eastman Corp., Oak Ridge, Tenn.

A SOLUBILITY METHOD OF THE DETERMINATION OF NON-VOLATILE MATERIAL IN TETRACHLORIDE CHARGES. Charles Sterett and J. R. Van Wazer. Apr. 26, 1945. Decl. Dec. 15, 1955. 8p. Contract W-7401-eng-23. (CD-GS-37). $1.80(ph OTS); $1.80(mf OTS).

This report suggests using methyl acetate extraction of charge material as a means of determining the non-volatile residue. It is shown that the volatile constituents of charge material are all extremely soluble in methyl acetate whereas the non-volatile materials are quite insoluble. Percent NVM on several samples of charge material by this method are reported and discussed. (auth)

4222 AECD-3956

Tennessee Eastman Corp., Oak Ridge, Tenn.

FACTORS AFFECTING THE CHLORINATION OF URANIUM COMPOUNDS WITH LIQUID CARBON TETRACHLORIDE. R. S. Lowrie and C. E. Larson. Nov. 11, 1956. 48p. Decl. Dec. 19, 1955. Contract W-7401-eng-23. (C-0.350.24). $7.80(ph OTS); $3.30(mf OTS).

The liquid phase production of UCl_5 or UCl_4 by the reaction of UO_3 with CCl_4 is a simple, straight forward reaction. Either U compound can be made by merely varying the pressure at which the reaction is run. Uranium hexachloride is difficult to produce in a pure form by using a liquid phase reaction of UO_3 and CCl_4. Since the solution

must be saturated with UCl_5 and must have an excess of chlorine present to shift the equilibrium, the product is rarely more than 80% UCl_6. (auth)

4223 AECD-3957

Tennessee Eastman Corp., Oak Ridge, Tenn.

[URANIUM] PEROXIDE. PART III. DISCUSSION OF THE SOLUBILITY OF [URANIUM] PEROXIDE IN SULPHATE SOLUTIONS BASED ON THE [URANYL] SULPHATE ASSOCIATION HYPOTHESIS. P. F. Grieger and J. W. Gates, Jr. May 28, 1945. Decl. Dec. 22, 1955. 21p. Contract W-7401-eng-23. (CD-4023). $4.80(ph OTS); $2.70(mf OTS).

The solubility of UO_4 in sulfate solutions (over a range, pH = 1 to 3, and SO_4^{2-} concentration 0 to 0.5 M) can be satisfactorily accounted for by assumptions of 1-1 and 1-2 interactions of UO_2^{2+} with SO_4^{2-}. (auth)

4224 AECD-3963

Tennessee Eastman Corp., Oak Ridge, Tenn.

RECOVERY FROM SALVAGE RESIDUE BY FLUORINATION IN VERTICAL REACTORS. K. Stevenson, Jr., A. G. Blasewitz, and G. H. Clewett. Sept. 6, 1946. Decl. Dec. 21, 1955. 57p. Contract W-7401-eng-23. (C-5.355.10). $9.30(ph OTS); $3.60(mf OTS).

Pilot-plant investigations of the $HF-F_2$ treatment of general Beta Process salvage residue, pelletized and charged to vertical reactors in deep beds, for U recovery are reported. Hydrofluorination of the residue removes the interfering silicates and fluorination removes the U. (C.W.H.)

4225 AECD-3993

Columbia Univ., New York. Div. of War Research.

[SPECIFICATIONS FOR THE FREEZING POINT METHOD FOR DETERMINATION OF THE AMOUNT OF HF IN UF_6.] Homer F. Priest. Feb. 26, 1944. Decl. Jan. 6, 1956. 14p. Contract W-7405-eng-50. (3B-L-114). $3.30(ph OTS); $2.40(mf OTS).

Detailed specifications for the cell body, valve, thermocouple well, oven, thermojunction, circuit, and calibration of the apparatus for determining HF in process gas by freezing point lowering are given. Specifications on cleaning of new process-gas cylinders are included. (G.Y.)

4226 CC-2095

[Chicago. Univ.] Metallurgical Lab.

URANIUM OXIDE SLURRY PUMPING EXPERIMENTS. Terminal Report—Problem Assignment No. 182 MLC. 2602. R. Bradt and G. R. Dean. Sept. 15, 1944. Decl. Dec. 13, 1955. 10p. $1.80(ph OTS); $1.80(mf OTS).

Experiments on colloid milling and pumping show that UO_3, when carefully dehydrated, can be dispersed in H_2O to form a relatively stable slurry, suitable for a homogeneous slurry pile. At temperatures considerably below those of anticipated pile operation particle size growth occurs attended by increase in settling rate and decrease in viscosity. These properties of the slurries may be strongly affected by impurities present as well as by special operating conditions. (auth)

4227 CC-2730

[California. Univ., Berkeley. Radiation Lab.]

COMPLEXING AGENTS FOR THE SOLVENT EXTRACTION OF URANIUM FROM THORIUM. I. THE USE OF THIOCYANATE IN THE EXTRACTION OF URANIUM. II. THE USE OF ANTIPYRINE IN SOLVENT EXTRACTION. W. H. Reas. Feb. 16, 1945. Decl. Dec. 16, 1955. 12p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

The separation of U from Th in aqueous solutions by solvent extraction was investigated. Hexone will extract 83% of the U and 0.3% of the Th from aqueous solutions containing thiocyanate while chloroform solutions of antipyrine will extract 90% of the U and 5% of the Th from aqueous solutions. (C.W.H.)

4228 CC-3424

Clinton Labs., Oak Ridge, Tenn.

COMPOSITION AND THERMAL DECOMPOSITION OF URANYL PEROXIDE. R. F. Leininger, J. P. Hunt, and D. E. Koshland, Jr. June 30, 1945. Decl. Jan. 5, 1956. 21p. Contract W-7405-eng-39. $4.80(ph OTS); $2.70(mf OTS).

Studies have been made on the composition and thermal decomposition of uranyl peroxide. The conditions of precipitation and drying have been found to have no appreciable effect on the composition of the compound, but do affect the physical appearance of the precipitate and the rate of thermal decomposition. The $UO_4 \cdot 2H_2O$ appears to be thermodynamically unstable with respect to UO_3 at 25°C and atmospheric pressure, although the rate of conversion is extremely slow. The $UO_4 \cdot 2H_2O$ is completely converted to UO_3 on standing at 150°C and atmospheric pressure for two weeks. Partially decomposed uranyl peroxide samples contain extra oxygen which is released on immersing the sample in water. (auth)

4229 CF-52-1-124

[Oak Ridge National Lab., Tenn.]

SOME PHYSICAL PROPERTIES OF $UO_2SO_4-D_2O$ SOLUTIONS. R. Van Winkle. Jan. 18, 1952. Decl. Jan. 5, 1956. 22p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Some calculated values are presented of the density, specific heat, and viscosity of UO_2SO_4 in D_2O, which were made using known physical properties of pure H_2O, UO_2SO_4 and D_2O, with the assumption that the ideal solution laws hold for these mixtures. The individual physical properties are reported in detail. (J.E.D.)

4230 CP-2315

[Chicago. Univ. Metallurgical Lab.]

THE THERMAL CONDUCTIVITY OF URANIUM. H. R. Kratz and C. H. Raeth. Dec. 18, 1944. Decl. Jan. 4, 1956. 14p. Contract W-7401-eng-37. $3.30(ph OTS); $3.00(mf OTS).

The thermal conductivity of uranium as a function of temperature is measured by comparing its conductivity with that of a sample of brass. An absolute measurement is then made of the conductivity of the brass sample. The thermal conductivities as a function of temperature of two samples of extruded uranium rod are given. (auth)

4231 CT-2529

[Chicago. Univ. Metallurgical Lab.]

CORROSION OF URANIUM SLUGS IN HEATED AIR. Final Report on a Phase of Problem No. 390-ML-51-S. R. N. Lyon. Dec. 21, 1944. Decl. Dec. 15, 1955. 5p. Contract W-7401-eng-37. $1.80(ph OTS); $1.80(mf OTS).

A test was made to determine the rate of corrosion of uncoated U "eggs" in air at temperatures ranging from 100 to 165°C to determine the advisability of building a low-power air-cooled pile using bare metal slugs. It was found that very little corrosion took place, and that the original oxide scale on the slugs afforded better protection than did the oxide coating which formed on a freshly machined slug during operation of the test. (G.Y.)

4232 CT-2965

[Chicago. Univ. Metallurgical Lab.]

PURIFICATION OF TUBALLOY BY THE THERMAL DECOMPOSITION OF TUBALLOY IODIDE. Final Report on a Part of P. A. No. MM 1.1. M. Fine, A. Mendelson, and D. L. Schwartz. May 15, 1945. Decl. Dec. 22, 1955. 13p. Contract W-7401-eng-37. $3.30(ph OTS); $2.40(mf OTS).

Refining of U by the thermal decomposition of UI_4 depends on the formation and subsequent decomposition of the iodide on a hot surface. Two types of hot surfaces were used: (1) hot wire heated by its electrical resistance, and (2) hot tube heated externally by a furnace. In order to produce substantial amounts of metal a flow system with H_2 had been found necessary. The proper mixture of H_2 and I_2 was passed over the crude U forming UI_4 and UI_3. UI_4, only, is volatile and when the gaseous mixture is passed over the hot surface some of the UI_4 decomposes to free metal. This report summarizes research from Sept. 15, 1944 to Mar. 1, 1945 and which was a continuation of that described in CK-2278. The objective of the program was to prepare a supply of pure U for use in special research problems. The work was discontinued because metal of satisfactory purity could not be produced. (auth)

4233 CT-3043

[Chicago. Univ. Metallurgical Lab.]

AUTOCLAVE TESTS OF TUBALLOY [URANIUM] SLUGS AND ALLOYS. N. Bensen, R. P. Straetz, and J. E. Draley. June 4, 1945. Decl. Jan. 5, 1956. 20p. Contract W-7401-eng-37. $3.30(ph OTS); $2.40(mf OTS).

Bare U slugs 1.4 inches in diameter corrode in distilled H_2O in a steam autoclave at 130 to 150 psi at an average constant rate of 139 mg/cm^2/hr based on original area. Steam corrosion of bare U slugs, at 130 to 150 psi is roughly the same as in water for about 2 hours, but is much higher and erratic after that time, measured average values being as high as 1630 mg/cm^2/hr. Pinholed, Al jacketed slugs corroded in steam at 130 to 150 psi, due to the formation of UH_3 which expanded to pimple the jacket of the slug in every case tested. Uranium binary alloys (including Si, Mo, Ta, Zr, and Nb) were tested in liquid distilled water under steam pressure of 130 to 150 psi with certain Nb and epsilonized Si alloys proving resistant to corrosion. (auth)

4234 CT-3044

[Chicago. Univ. Metallurgical Lab.]

A STUDY OF THE REACTION RATE BETWEEN TUBALLOY METAL AND PURIFIED HYDROGEN. R. P. Straetz and J. E. Draley. June 20, 1945. Decl. Jan. 5, 1956. 22p. Contract W-7401-eng-37. $4.80(ph OTS); $2.70(mf OTS).

Early investigations showed that hydrogen played an important role in the corrosion of jacketed tuballoy [U] slugs in aqueous medium. In an effort to afford an understanding of these phenomena, an investigation was undertaken to determine the rate of reaction of purified hydrogen at atmospheric pressure with clean tuballoy metal and tuballoy alloys at temperatures ranging from room temperature to 300°C. The reaction of tuballoy hydride with hydrogen saturated water and the development of methods of handling hydride were also studied. Results are tabulated and the test equipment is described and illustrated photographically. (auth)

4235 ISC-139

Ames Lab., Ames, Iowa.

PHASE STUDIES OF URANIUM–ZIRCONIUM ALLOYS. David Peterson and H. A. Wilhelm. Dec. 1950. Decl. Jan. 6, 1956. 79p. Contract W-7405-eng-82. $12.30 (ph OTS); $4.50(mf OTS).

The U–Zr phase system was studied by thermal methods, microscopic examination, and x-ray diffraction. The alloys were prepared by bomb reduction of UF_4 and ZrF_4, powder metallurgy, vacuum melting, and arc melting. Hardness of the alloys was measured, and their ability to undergo mechanical working was investigated. The solidus and liquidus lines in this phase diagram have no maximum, minimum, or horizontal portion. A continuous solid solution exists between α U and β Zr. The solubility of Zr in α U was established as less than 0.6% at 579°C and the solubility in β U is less than 1.2% at 694°C. The $\beta-\alpha$ transition is lowered to 683°C by the addition of Zr and the $\alpha-\beta$ transition is raised to 683°C at 1.9% Zr. A eutectoid transformation at that temperature was observed up to 30.1% Zr. The solubility of U in α Zr is probably between 2.3 and 4.4% U at 580°C. A thermal arrest was observed at 605°C which was interpreted as being due to a eutectoid in the system at that temperature arising from the $\alpha-\beta$ transition in Zr. X-ray-diffraction data indicated that both α U and α Zr were present in slow cooled and quenched alloys containing from 30% to 70% Zr. (G.Y.)

4236 K-130

Carbide and Carbon Chemicals Corp. [K-25 Plant], Oak Ridge, Tenn.

THE DETERMINATION OF MICRO AMOUNTS OF CARBON IN URANIUM TETRAFLUORIDE. H. A. Bernhardt, W. Brickell, W. W. Harris, and R. R. Rickard. Jan. 26, 1948. Decl. Jan. 5, 1956. 10p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Two combustion methods for the determination of C in UF_4 are described. Volatilization of the UF_4 is prevented in one method by reaction with ZnO_2 and in the other by reaction with wet O_2. The combustion is carried out in a platinum tube packed with NaF pellets which prevent the carry over of volatile fluorides into the carbon dioxide absorption tube. From 0 to 1700 ppm of C can be determined by either method, and for half gram samples of UF_4, the 95% confidence limit of a single determination by either method in the range of 0 to 400 ppm of C is about ±40 ppm of C. For the entire range from 0 to 1700 ppm, the 95% confidence limit is ±60 ppm of C by the ZnO_2 method and ±140 ppm of C by the wet O_2 method. (auth)

4237 K-389

Carbide and Carbon Chemicals Corp. K-25 Plant, Oak Ridge, Tenn.

URANIUM RECOVERY FROM DECONTAMINATION SOLUTIONS BY SPRAY DECOMPOSITION. A. L. Allen, H. A. Bernhardt, S. Bernstein, R. H. Harrison, and E. W. Powell. Apr. 27, 1949. Decl. Jan. 6, 1956. 18p. (KLO-94). $3.30 (ph OTS); $2.40(mf OTS).

An alternate method for the recovery of U from decontamination solutions is proposed to replace the ammonium diuranate precipitation and filtration method. The method consists of atomizing a solution of $UO_2(NO_3)_2$ into a heated chamber where the H_2O is driven off and the nitrate decomposed almost instantaneously to UO_3. The UO_3 is then transferred to a fluorination system where it is

converted to UF_4 for refeed to the gaseous diffusion cascade. (auth)

4238 K-579

Carbide and Carbon Chemicals Div. K-25 Plant, Oak Ridge, Tenn.

THE COSEPARATION OF ZIRCONIUM AND NIOBIUM WITH URANYL AMMONIUM PHOSPHATE. Sidney Katz. Mar. 22, 1950. Decl. Jan. 3, 1956. 18p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

Coprecipitation by surface absorption is shown to be the principal mechanism for the coseparation of radioactive Zr and Nb with uranyl ammonium phosphate. A procedure for precipitation of filterable uranyl ammonium phosphate from H_3PO_4 solution has been developed. This procedure compared to the precipitation from nitric acid solution reduces the coseparation with 11 g of uranyl ammonium phosphate from 100 ml of 1.5M acid solution as follows: Zr, 95% to 24%; Nb, 98% to 67%. (auth)

4239 K-586

Carbide and Carbon Chemicals Div., K-25 Plant, Oak Ridge, Tenn.

SEPARATION OF RUTHENIUM FROM URANIUM HEXAFLUORIDE. R. A. Gustison, S. S. Kirslis, T. S. McMillan, and H. A. Bernhardt. Apr. 26, 1950. Decl. Jan. 6, 1956. 33p. Contract W-7405-eng-26. $6.30(ph OTS); $3.00(mf OTS).

In the UAP process for recovery of U from Hanford waste, Ru^{106} is an undesirable radioactive contaminant in the phosphate precipitate. Ruthenium forms a very reactive volatile fluoride which is carried along with the UF_6 when uranyl ammonium phosphate is fluorinated. It was found that passing the UF_6 through a distillation column effectively reduces the Ru activity in UF_6 to an acceptable level. It was shown that the decontaminating effect of the distillation operation was due largely to the scrubbing of ascending gases by refluxing liquid UF_6. To a lesser extent, absorption of Ru on the column packing and the distillation action contributed to the decontamination. (auth)

4240 KAPL-718

Knolls Atomic Power Lab., Schenectady, N. Y.

SOLVENT EXTRACTION OF PLUTONIUM AND URANIUM FROM SAMPLES TYPICAL TO KAPL HEALTH PHYSICS LABORATORY. R. Z. Bouton and R. W. Trevithick. Dec. 1951. Decl. Jan. 5, 1956. 23p. Contract W-31-109-eng-52. $3.30(ph OTS); $2.40(mf OTS).

Analytical procedures have been established for the solvent extraction of Pu and U from water, river silt, soil, ash, vegetation, and oil samples. Diethyl ether is used as the solvent and aluminum nitrate as the salting agent. The efficiency of the analyses in the detection of Pu and U ranges from approximately 50% for ash to 80% for oil and water samples. The methods are intended to serve in health physics site monitoring. (auth)

4241 LA-422R

Los Alamos Scientific Lab., N. Mex.

PLASTIC BONDING OF URANIUM HYDRIDE AND OTHER MATERIALS. J. E. Burke, M. Arnold, D. J. Baker, S. Calvert, J. Church, L. A. Hays, and R. H. Kirby. Oct. 5, 1945. Decl. Dec. 9, 1955. 25p. Contract [W-7405-eng-36]. $4.80(ph OTS); $2.70(mf OTS).

By bonding U hydride with synthetic resins, it is possible to produce compacts which are nonpyrophoric, and which have densities as high as 9.0 g/cm^2. If the presence of carbon can be tolerated, almost any H to U ratio can be obtained by use of suitable mixtures of pure metal and hydride powders. The product is readily handleable, and almost any desired shape can be made. A similar technique can be used to bond other powdered substances, the products having a variety of properties. (auth)

4242 LWS-24552

California Research and Development Co., Livermore, Calif.

AN ALTERNATIVE "MECHANISM" OF THE DIMENSIONAL INSTABILITY OF URANIUM. J. P. Frankel and G. W. Brown. Sept. 18, 1952. Decl. Jan. 7, 1956. 13p. (CRD-T1-164). $3.30(ph OTS); $2.40(mf OTS).

A theory is proposed to explain the dimensional stability of U subjected to thermal cycling. The theory proposed differs from existing theory in that the crystals of U are all presumed to grow at the same rate, no differential growth, such as allowed by grain boundary relaxation, being required. The theory is easily extended to the problem of the dimensional instability of multimetallic plates. The instability of composite metal components, quite apart from the inherent instability of the component metals, was predicted on the basis of this theory and confirmed in the laboratory. It was found that Cu plates clad on both sides by Zr grew approximately the same amount on thermal cycling as did similarly clad α-rolled U. β-treated U plates clad with Zr also grew approximately the same amount. In all cases severe warping was manifest. (auth)

4243 MCW-168

Mallinckrodt Chemical Works, St. Louis.

NOTES ON THE M.I.T. REPORTS REGARDING WORKING LOW-GRADE AFRICAN ORES. C. F. Ritchie. Feb. 15, 1949. Decl. Dec. 2, 1955. 10p. Contract [W-14-108-eng-8]. $1.80(ph OTS); $1.80(mf OTS).

Leaching and precipitation procedures developed at M.I.T. for low-grade African U ores are reviewed. H_2SO_4 and $Fe_2(SO_4)_3$ were used for leaching. MgO was preferred over lime for precipitation because of the lack of P_2O_5 in the MgO precipitates. Use of these techniques at the Mallinckrodt Chemical Works is discussed and some new experimental data are added in the tabulations. (C.H.)

4244 MCW-210

Mallinckrodt Chemical Works, St. Louis.

REDUCTION OF U_3O_8 WITH HYDROGEN REACTION RATE. C. W. Kuhlman. Aug. 19, 1949. Decl. Dec. 7, 1955. 9p. Contract [W-14-108-eng-8]. $1.80(ph OTS); $1.80(mf OTS).

The rate of the reaction $U_3O_8 + 2H_2 \rightarrow 3UO_2 + 2H_2O$ was studied using large excesses of H and reasonably thin layers of U_3O_8. The kinetics of this reaction were found to be indistinguishable from those found for the reaction $UO_2 + H_2 \rightarrow UO_2 + H_2O$. From this it was concluded that the first reaction represents a rate determining step in the second reaction. Data are presented graphically. (C.H.)

4245 N-1974

[Chicago. Univ. Metallurgical Lab.]

THE DETERMINATION OF NEUTRON ABSORPTION BY THE "SHOTGUN" METHOD. L. Myers, Jr. Revisions by M. W. Asprey and G. A. Cowan. [nd]. Decl. Jan. 5, 1956. Contract [W-7401-eng-37]. (MUC-JIW-297). $4.80(ph OTS); $2.70(mf OTS).

The shotgun method is a relative procedure for the determination of slow neutron absorption by any substance. It is applied specifically to neutron absorption by impurities in

U materials. The method involves concentration of the impurities from a large amount of material into a few grams; neutron irradiation of an In foil in the presence of these impurities; determination of the resulting activity of the In foil; comparison of this activity with the activity of foils irradiated in the presence of known amounts of a standard impurity, namely boron; and calculation of the per cent neutron absorption. A uranium assay of the impurities is often necessary for this calculation. Details of the method are presented. (C.H.)

4246 NYO-5075

Mallinckrodt Chemical Works, St. Louis.

DETERMINATION OF FREE XO_2 [UO_2] BY IGNITION TO X_3O_8 [U_3O_8]. R. W. Bragdon. Jan. 18, 1945. Decl. Dec. 8, 1955. 5p. $1.80(ph OTS); $1.80(mf OTS).

UO_2 ignited at 800°C had a near perfect molar ratio of UO_3 TO UO_2. Presence of 0.02% H_2O found in UO_2 lowered the ignition assay by about 0.5%. Failure to substract a blank on reagents in the volumetric assays raised the assay about 0.2%. The best UO_2 determination procedure is specified. (C.H.)

4247 NYO-5123

Mallinckrodt Chemical Works, St. Louis.

FURTHER INVESTIGATIONS OF INTERFERENCES IN THE TITRATION OF X [U]. J. R. McCoy, G. L. Martin, and T. R. Braddock. June 8, 1945. Decl. Dec. 14, 1955. 3p. $1.80(ph OTS); $1.80(mf OTS).

The suspected presence of Ni, Bi, and Cr in high-grade pitchblende ore led to investigation of the possibility of interference by these elements in the volumetric determination of U, in which reduction in a Jones reductor is followed by titration with $Ce(SO_4)_2$. None of the elements interfered in the analysis or varied the numerical results, but the presence of Ni resulted in eventual deterioration of the Jones reductor. A step was added, therefore, to the analytical procedure in order to remove Ni by precipitation with dimethylglyoxime followed by extraction with chloroform. (G.Y.)

4248 NYO-5194

Mallinckrodt Chemical Works, St. Louis.

A STUDY OF SOME FACTORS AFFECTING THE INTERFERENCE OF SOME ELEMENTS IN THE TITRATION OF URANIUM. G. L. Martin and J. R. McCoy. Aug. 23, 1946. Decl. Dec. 6, 1955. 12p. $3.30(ph OTS); $2.40(mf OTS).

A standard volumetric procedure for the determination of U involves a reduction of the sample in a Jones reducer followed by aereation to oxidize any trivalent U to tetravalent, and finally a titration of the tetravalent U with an oxidizing agent such as ceric sulfate. An investigation was made of elements which interfere in the determination and of methods to remove the interference. Data are presented on Fe, U, Mo, and Ti. (C.H.)

4249 NYO-5211

Mallinckrodt Chemical Works, St. Louis.

AN INVESTIGATION OF PRESENT METHODS FOR THE COLORIMETRIC DETERMINATION OF SMALL AMOUNTS OF URANIUM IN RESIDUES. Samuel Huston. Nov. 28, 1947. Decl. Dec. 2, 1955. 22p. $4.80(ph OTS); $2.70(mf OTS).

An evaluation was made of two methods for the colorimetric determination of U. The method most frequently used is the $NaCO_3-H_2O_2$ method in which the U develops a colored complex when H_2O_2 is added to its alkaline carbonate solution. The less frequently used method was designed for use where the presence of V is known or suspected. A strong caustic solution is boiled to remove the V color, and after cooling, the U color is developed. Prior to starting work on the actual procedures, a brief study was made of the precision of the Coleman and Backman spectrophotometers. The Coleman instrument was specified for the methods presented. (C.H.)

4250 NYO-5221

Mallinckrodt Chemical Works, St. Louis.

AN EXAMINATION OF THE TITRATION PROCEDURE FOR THE URANIUM ASSAY AS USED BY THE NATIONAL BUREAU OF STANDARDS AND THE MALLINCKRODT CHEMICAL WORKS. Joseph R. Simmler. Feb. 27, 1948. Decl. Dec. 2, 1955. 19p. $3.30(ph OTS); $2.40(mf OTS).

The titration procedures used in the assaying of uranium by the Mallinckrodt Chemical Works and the National Bureau of Standards are compared. The Mallinckrodt titration procedure consists of reducing the uranyl solution through a Jones reductor and then aerating. The resulting uranous solution is titrated with standardized ceric sulfate to an ortho-phenanthroline ferrous complex indicator (Ferroin) color change. Phosphoric acid is present as a catalyst. The National Bureau of Standards titration procedure involves the reduction of the uranyl solution through a Jones reductor, followed by aeration of the solution. To the uranous solution is added an excess of ferric chloride and phosphoric-sulfuric acid mixture. The resulting ferrous ions are titrated to a diphenylamine sulfonate indicator color change with standardized potassium dichromate. The amount of uranium titrated in the Mallinckrodt procedure is about 2.5 times the amount of uranium titrated by the Bureau, and the normality of the ceric sulfate is about 0.08N as compared to the 0.027N dichromate used by the Bureau. Therefore, the Bureau procedure uses substantially more dilute solutions. Also, the Bureau procedure is essentially a titration of the ferrous ions with dichromate while the Mallinckrodt procedure is a direct titration of the uranous ions. The examination of the effect of catalysts on the rate of reaction between the uranous ions and ceric ions followed after it was observed that the rate of reaction of these two ions was slow. (auth)

4251 ORNL-37

Oak Ridge National Lab., Tenn.

THE DISTRIBUTION COEFFICIENTS OF URANIUM AND FISSION PRODUCTS IN HEXONE EXTRACTION. Progress Report [for] June 18, 1947 to July 10, 1947. Technical Div., Chemical Process Development Section. F. R. Bruce. May 13, 1948. Decl. Jan. 6, 1956. 16p. Contract [W-31-109-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Nomographs which define the distribution ratios of U and fission products as functions of $Al(NO_3)_3$ and HNO_3 concentrations in the $H_2O-Al(NO_3)_3-HNO_3-UO_2(NO_3)_2-$ hexone system are presented. (auth)

4252 ORNL-178

Oak Ridge National Lab., Tenn.

TERTIARY ALCOHOLS AS SOLVENTS FOR THE EXTRACTION OF URANIUM. M. R. Poston, B. I. V. Bailey, and W. H. Baldwin. Feb. 22, 1949. Decl. Jan. 5, 1956. 14p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

During a search for suitable solvents to replace hexone for the selective extraction of heavy metal nitrates, especially uranyl and plutonyl, a series of tests were conducted on an homologous series of tertiary alcohols in which miscibility with water is decreased with increasing molecular

weight. 2-Methyl 2-pentanol, 2-methyl 2-hexanol, and 2-methyl 2-heptanol were synthesized and 2-methyl 2-butanol was obtained commercially. The distribution of U and Ru tracer was determined between these organic solvents and an equal volume of an aqueous phase containing HNO_3 and $Al(NO_3)_3$. Hexone gave better results than the other solvents tested. (C.H.)

Refer also to abstract 4132.

WASTE DISPOSAL

4253 CF-51-11-123
Oak Ridge National Lab., Tenn.
EVALUATION OF REAGENT DECONTAMINATION. Quarterly Report for Period August 10, 1951—November 10, 1951. M. R. Bennett. Nov. 21, 1951. Decl. Dec. 22, 1955. 11p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

An evaluation was made of the decontamination and corrosion properties of various reagent mixtures on welded and non-welded specimens of types 309 and 347 stainless steel. A reagent mixture of 20% HNO_3—3% HF (by weight) was found to be superior to all other reagents tested in both decontamination and corrosion properties. (C.H.)

4254 HW-31011
Hanford Atomic Products Operation, Richland, Wash.
ADSORPTION AND RETENTION OF CESIUM BY SOILS OF THE HANFORD PROJECT. J. R. McHenry. Mar. 2, 1954. Decl. Jan. 6, 1956. 41p. Contract W-31-109-eng-52. $6.30(ph OTS); $3.00(mf OTS).

The adsorption of Cs ion from solution by a composite Hanford soil is a function of Cs ion concentration, pH, time of contact, total salt content, and the nature and concentration of the complementary ions. Adsorption is linear, and nearly complete, for increasing concentrations of Cs until the Cs concentration approaches the saturation capacity of the soil. The percentage adsorption of Cs from solution as the concentration approaches the saturation capacity decreases rapidly. Adsorption from a number of increments of Cs solution by a given unit of soil is progressively less, approaching as a limit the soil saturation capacity. Adsorption at pH 8.0 and higher is relatively unchanged; below a pH 8.0 uptake by the soil decreases rapidly with increasing acidity. Increasing concentrations of complementary ions and total salt provide increasingly greater competition to the adsorption of cesium. A 40% solution of $NaNO_3$ decreases the Cs uptake by one-half for very low concentrations of Cs. Equilibrium adsorption is accomplished in a matter of minutes for a given set of conditions. Removal of adsorbed Cs by leaching with a solution is a function of the nature, concentration, and volume of a given cation, hydrogen ion being the most effective. However, all cations employed, if sufficient volume is employed, are capable of replacing and removing the adsorbed Cs. Replacement is most rapid for solutions of greatest cation concentrations and for soils containing the greatest amount of adsorbed Cs. (auth)

4255 ORNL-393
Oak Ridge National Lab., Tenn.
DESIGN AND INITIAL OPERATION OF THE RADIOCHEMICAL WASTE EVAPORATOR. E. L. Nicholson. Sept. 22, 1949. Decl. Jan. 6, 1956. 71p. Contract W-7405-eng-26. $12.30(ph OTS); $4.50(mf OTS).

Design data and operating results on several of the first evaporator runs are presented for the radiochemical waste evaporator. The evaporator is designed to evaporate 300 gal/hr of water from a radiochemical waste feed with a minimum concentration factor of twenty to one and a decontamination factor greater than 10^3. The evaporator is capable of continued operation under adverse scaling and corrosive conditions. Results from the first runs show that design specifications have been exceeded for concentration factor and decontamination. Foaming has been held to a minimum by adjusting evaporator liquid level and using anti-foam agents. (auth)

ENGINEERING

4256 K-362
Carbide and Carbon Chemicals Corp. K-25 Plant, Oak Ridge, Tenn.
RECLAMATION OF DEFECTIVE HOKE DIAPHRAGM TYPE PACKLESS VALVES. N. H. Pease. Mar. 2, 1949. Decl. Dec. 5, 1955. 8p. $0.15(OTS).

AEROSOLS

4257 ORNL-500
Oak Ridge National Lab., Tenn.
EVALUATION OF FILTERING EFFICIENCY AND OPERATING LIFE OF FG MATERIAL USED IN PILE COOLING AIR FILTER HOUSE. H. C. Savage. Dec. 1, 1949. Decl. Jan. 6, 1956. 19p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

An experimental investigation of the relative efficiencies and operating life of three combinations of American Air Filter Company's FG filter media as used in the pile cooling air filter house at Oak Ridge National Laboratory is reported. (G.Y.)

HEAT TRANSFER AND FLUID FLOW

4258 AECD-3873
General Electric Co. General Engineering and Consulting Lab., Schenectady, N. Y.
THERMAL TEST UNIT. A. Cohen and G. R. Rede. May 31, 1950. Decl. Dec. 2, 1955. 27p. (R50GL20; EAH-136). $7.80(ph OTS); $3.30(mf OTS).

The design, calibration, and testing of a heat transfer testing unit are discussed. Heat generated from electrical energy in a 24-ft Al tube is transferred to water flowing along the length of the tube. (K.S.)

4259 AECD-4004
California Research and Development Co., Livermore, Calif.
INSTANTANEOUS THERMAL STRESSES AND TEMPERATURES IN UNRESTRAINED FLAT PLATES AND THIN WALLED CYLINDRICAL TUBES. (Extension of CRD-T2B-47). J. E. Mahlmeister. [Oct. 19, 1951]. Decl. Jan. 4, 1956. 4p. (CRD-T2B-61; LWS-24190). $1.80(ph OTS); $1.80(mf OTS).

4260 CP-2313
Chicago. Univ. Metallurgical Lab.
THERMAL TRANSFER TO AN ANNULAR WATER STREAM IN THE NEIGHBORHOOD OF A RIB. H. R. Kratz, R. Schlegel, and C. F. Christ. Nov. 10, 1944. Decl. Jan. 4, 1956. 30p. $4.80(ph OTS); $2.70(mf OTS).

Steady-state temperatures were measured in an electrically heated brass cylinder which was water cooled in a four-ribbed Al tube. Thermal transfer coefficients h were calculated from the measured temperatures. Curves of h values are presented for the regions of high and low ribs. The h curve is found to show a much sharper break in the region of a high rib than in a low rib region. There is some evidence that h decreases linearly with annular thickness in the range considered. The low rib is found to exert a much greater effect than the high rib in decreasing the h value at points distant from the rib. (auth)

4261 CP-2629
[Chicago. Univ. Metallurgical Lab.]
ESTIMATES FOR THE MAXIMUM SURFACE TEMPERATURE FOR A SLUG DISPLACED FROM THE CENTER OF THE TUBE. F. H. Murray. Jan. 9, 1945. Decl. Dec. 14, 1955. 9p. Contract W-7401-eng-37. $1.80(ph OTS); $1.80(mf OTS).

When a slug has been displaced from its normal position the thickness of the water film is decreased over part of the surface, and higher temperatures may be expected where the film is thin. The experimental data necessary for an exact calculation is incomplete, but some approximate estimates are made with special assumptions concerning the heat transfer coefficient has a function of the angle Φ from the point where the water film is thinnest. Variation in water bulk temperature around the annulus due to poor mixing is not considered. (auth)

PUMPS

4262 AECD-3831
North American Aviation Inc., [Downey, Calif.].
ISOTHERMAL PUMP LOOP. R. Keen. Oct. 22, 1952. Decl. Dec. 5, 1955. 10p. Contract [AT-11-1-GEN-8]. (NAA-SR-Memo-469). $3.30(ph OTS); $2.40(mf OTS).

A centrifugal pump built entirely of graphite and capable of handling liquid metals in the temperature region of 1000°C is described. The pump was designed to meet the requirements of a high-temperature reactor. (J.E.D.)

WASTE DISPOSAL

4263 ORNL-1513
Oak Ridge National Lab., Tenn.
ORNL RADIOCHEMICAL WASTE EVAPORATOR PERFORMANCE EVALUATION, DECEMBER 1949 THROUGH DECEMBER 1950. E. M. Shank. June 26, 1953. Decl. Jan. 6, 1956. 32p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

The evaporator is described briefly, the operating procedure outlined, and the effect of feed composition discussed. A description is given of the instrumentation for condensate activity monitoring and the foam-level indicator. The proposed condensate resin column layout plan is included. (L.M.T.)

MINERALOGY, METALLURGY, AND CERAMICS

CORROSION

4264 AECD-3778
Production Div., AEC.
CORROSION RESISTANCE OF MATERIALS TO AN HF–H_2O–H_2SO_4 SYSTEM. J. P. Termini. July 7, 1952. Decl. Nov. 29, 1955. 3p. (M-5082). $1.80(ph OTS); $1.80(mf OTS).

Approximate corrosion values are tabulated for Monel, Pb, Chlorimet 3, Carpenter 20, Hastelloy C, Cu, Worthite, Ilium C, Dowmetal M, and Karbate No. 22 in various combinations of HF, H_2SO_4, fluosilicic acid, and H_2O. The data were compiled to assist in design of HF extractive distillation apparatus. No definite conclusions are given. (G.Y.)

4265 AECD-3779
Carbide and Carbon Chemicals Corp., Oak Ridge, Tenn.
MINUTES OF CORROSION MEETING, OCTOBER 21, 1946. H. V. Klaus and S. H. Smiley. Decl. Nov. 28, 1955. 5p. (KZ-1040). $1.80(ph OTS); $1.80(mf OTS).

The corrosion of the coolant coolers in the K-27 and K-25 plants is discussed. Maximum pit depths in various coolers are summarized, and a program to correct or minimize coolant cooler corrosion is outlined. (B.J.H.)

4266 AECD-3900
[Massachusetts Inst. of Tech., Cambridge.]
FINAL REPORT ON THE PREPARATION AND CORROSION TESTING OF BRAZED ALUMINUM JOINTS. J. E. Atherton, Jr. and Ellis Field, Jr. Feb. 9, 1948. Decl. Dec. 6, 1955. 12p. (MIT-JEA-6). $3.30(ph OTS); $2.40(mf OTS).

Experiments are described which were designed to test a vacuum-tight brazed Al joint against corrosion in an air atmosphere at 350°C. A technique was developed whereby vacuum-tight joints were made in brazing a 2S cap to a 2S tube by furnace brazing with Alcoa brazing rods and an Al–Si alloy as filler material. Experimental details are described. (C.H.)

4267 AECD-4017
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh].
ZIRCONIUM ALLOY CORROSION DATA SUBMITTED TO THE ZIRCONIUM ALLOY CORROSION COMMITTEE MEETING, MAY 17 AND 18, 1954. Stanley Kass. Decl. Jan. 14, 1956. 63p. (WAPD-MM-421). $10.80(ph OTS); $3.90(mf OTS).

Numerous data on corrosion of Zircaloy-2, Zircaloy-3, and various Zr-base alloys in 680°F H_2O, 600°F hydrogenated H_2O, 750°F steam, etc., are compiled. The effects of the various compositions and heat treatments are shown. (G.Y.)

4268 CF-51-11-186
Oak Ridge National Lab., Tenn.
OPERATION OF A Ni-NaOH THERMAL CONVECTION LOOP. Nov. 29, 1951. Decl. Jan. 5, 1956. 11p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

In order to determine the effect of absence of O_2 and H_2O on mass transfer, a NaOH thermal convection loop was constructed of a ½-in. Ni tube, cleaned with dilute HCl and

H_2O, loaded with dehydrated NaOH in a He dry box, and sealed off under vacuum. The loop was operated for 316 hr with the hot leg at 705°C and the cold leg at 465°C. Although the loop was still functioning when it was cut down, it was found that considerable amount of mass transfer had occurred. Nickel was deposited in the form of dendritic and polyhedral crystals. These crystals were found in all but the hottest part of the loop, and were densest in the cold-leg. Because all oxides were not removed from the interior of the loop prior to the run and because the NaOH probably contained small amount of water, it cannot yet be stated that mass transfer will occur in a NaOH loop regardless of the O_2 and H_2O content. (J.E.D.)

4269 CT-1943

Chicago. Univ. Metallurgical Lab.

CORROSION RESEARCH—TUBALLOY AND ALLOYS. Progress Report No. 1 on Problem No. 391-ML-54-4e. J. E. Draley and G. C. English. July 1, 1944. Decl. Dec. 15, 1955. 14p. Contract [W-7401-eng-37]. $3.30(ph OTS); $2.40(mf OTS).

Corrosion rates were determined for U metal in static distilled water and in 10^{-5}N H_2O_2 at temperatures from room temperature to 90°C. Rates increase normally with temperature except that there is a 20-fold increase in a ten-degree rise between 70 and 80° in water and between 80 and 90° in 1×10^{-5}N H_2O_2. Rates below this sharp rise are probably not too serious, none exceeding 0.5 mil/mo. Corrosion rates of Al, Be, Cu, Cr, Pb, Si, Sn, Ni, and Sb alloys of U were determined. For alloys of the most promising metal, Ni, rates were measured in water and dilute peroxide–chloride mixtures at temperatures from 40 to 90°C. A marked increase in corrosion rate was noticed when the tests were run in a closed vessel, with no solution refreshment. In this system, the effects of surface preparation, surface oxide, pH, and concentration of other ions in the solution were measured. Some ideas of the galvanic effects of coupling to metals such as stainless steel and Al were also obtained. (auth)

4270 CT-3031

[Chicago. Univ. Metallurgical Lab.]

CORROSION OF TUBALLOY-MOLYBDENUM ALLOYS BY WATER. Joyce M. Hopkins, Frederick Nelson, and W. W. Binger. May 31, 1945. Decl. Jan. 4, 1956. 29p. Contract W-7401-eng-37. $4.80(ph OTS); $2.70(mf OTS).

A series of hot-rolled U alloys containing nominally 5% Mo by weight were tested in water heated in the autoclave by 125 psi steam pressure (178°C). The alloys were also tested in boiling water at atmospheric pressure to measure resistance to corrosion by distilled water which is essentially free of dissolved gases. The water-quenched and annealed alloys were more corrosion resistant than the alloys which were only water quenched or those which were furnace cooled. The furnace-cooled alloys cracked in test. The alloys which were melted in BeO crucibles showed slightly more corrosion resistance than the alloys melted in graphite crucibles. The most corrosion-resistant alloy tested in boiling distilled water at 100°C corroded at the average rate of 0.02 mg/cm^2/hr. Standard U corrodes approximately 135 times as rapidly under the same conditions. (auth)

4271 CT-3036

[Chicago. Univ. Metallurgical Lab.]

AQUEOUS CORROSION OF THORIUM AND THORIUM ALLOYS. J. W. Arendt, W. W. Binger, J. Hopkins, and F Nelson. June 23, 1945. Decl. Jan. 4, 1956. 31p. Contract W-7401-eng-37. $6.30(ph OTS); $3.00(mf OTS).

A study of the resistance to aqueous corrosion of extruded Ames Th, a cast material, and of extruded Westinghouse Th, a material made by powder metallurgy, as well as of thorium alloys in "as cast" condition is reported. Samples were exposed in air-free, relatively pure water at temperatures of 100 and 178°C and, also, in a simulated river water with added H_2O_2 (0.006N) flowing at 20 to 25 ft/sec at a temperature of 70°C. It was necessary to devise a suitable method to remove the corrosion products without removing unaltered metal, in order to obtain accurate corrosion rates of Th. The most satisfactory methods were treatment with 70 wt.% HNO_3 saturated with NaF at room temperature, and anodizing in 10 wt.% NaOH at 30 to 34°C. (auth)

4272 HW-14429

Hanford Works, Richland, Wash.

LIFE OF VAN STONE CORRECTIVE MEASURES. C. W. Botsford and E. A. Eschbach. Sept. 12, 1949. Decl. Dec. 22, 1955. 5p. Contract [W-31-109-eng-52]. $1.80(ph OTS); $1.80(mf OTS).

Available information on the life aspects of various measures proposed to reduce or eliminate corrosion of Van Stone flanges is summarized. (B.J.H.)

4273 HW-19165

Hanford Works, Richland, Wash.

CORROSION OF CONSTRUCTION MATERIALS IN TBP (HW-3 FLOWSHEET) PROCESS STREAMS. W. W. Koenig and K. L. Sanborn. Nov. 1, 1950. Decl. Dec. 8, 1955. 15p. Contract W-31-109-eng-52. $3.30(ph OTS); $2.40 (mf OTS).

A corrosion test program to determine the effect TBP process streams, which contain chlorides, have upon the corrosion resistance of several construction materials, was completed. Data are presented on the performance of Carpenter 20, T-309SCb, T-347, T-316 and tantalum in the RAF and RAW process streams and on the performance of titanium and zirconium in the RAW stream. (auth)

4274 HW-20725

[Hanford Works, Richland, Wash.]

CORROSION DATA FOR LaBOUR ALLOY R-55 AND WORTHITE IN UO_3 PROCESS STREAMS. K. L. Sanborn. Decl. Jan. 4, 1956. 3p. Contract [W-31-109-eng-52.] $1.80(ph OTS); $1.80(mf OTS).

A corrosion test program to determine the suitability of La Bour R-55 and Worthite for use in the construction of circulating pumps for the UO_3 process was completed. La Bour R-55 did not show satisfactory resistance to 65% HNO_3, though it was satisfactory when used with 78% $UO_2(NO_3)_2$. The Worthite, tested only in the $UO_2(NO_3)_2$ solution, showed satisfactory resistance. (B.J.H.)

4275 HW-22779

[Hanford Works, Richland, Wash.]

CORROSION OF STAINLESS STEEL TYPE 309SCb IN 200 AREA DISSOLVER SOLUTION CONTAINING MERCURIC ION. Kenneth L. Sanborn. Nov. 20, 1951. Decl. Jan. 7, 1956. 2p. Contract W-31-109-eng-52 . $1.80(ph OTS); $1.80(mf OTS).

Tests carried out on welded and as-received specimens showed normal corrosion rates except for the welded specimen exposed to control solution. In this case (Hg ion absent), the excessive rate was traced to the presence of inclusions in the weld deposit. The effect of the presence of

the Hg ion was therefore considered to be insignificant. (L.M.T.)

4276 HW-30641
Hanford Atomic Products Operation, Richland, Wash.
FIELD CORROSION TESTS—SAE 1020 STEEL IN BISMUTH PHOSPHATE PROCESS WASTE SOLUTION TANKS. N. Endow. Jan. 25, 1954. Decl. Jan. 6, 1956. 17p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

4277 HW-32755
Hanford Atomic Products Operation, Richland, Wash.
FIELD CORROSION TEST—SAE 1020 CARBON STEEL IN REDOX PROCESS WASTE SOLUTION TANK NO. 104, 241-S. N. Endow and K. L. Sanborn. Aug. 11, 1954. Decl. Jan. 6, 1956. 24p. Contract W-31-109-eng-52. $4.80(ph OTS); $2.70(mf OTS).

Data collected in corrosion tests on SAE 1020 steel specimens exposed in the radioactive waste solution from the Redox plant indicate that the corrosion rates do not differ significantly under conditions of self-concentration of wastes, from those measured in similar solutions at temperatures less than boiling. This observation may be considered valid for Redox waste up to 250°F and may apply at temperatures somewhat above 300°F. The maximum temperature recorded for the waste solution in the tank in which the specimens were exposed was 250°F, although temperatures in excess of 300°F may have been attained during the test. One stressed specimen was included in the test for the purpose of evaluating possible effects of stress corrosion cracking, but no evidence of stress corrosion cracking was observed after nine months exposure. (J.S.R.)

4278 ISC-214
Ames Lab., Ames, Iowa.
PROTECTION OF THORIUM AT ELEVATED TEMPERATURES. I. SILVER PLATING FOR SHORT-TIME ATMOSPHERIC EXPOSURE AT 700°C. R. T. Othmer and Glenn Murphy. April 10, 1952. Decl. Jan. 5, 1956. 8p. Contract W-7405-eng-82. $1.80(ph OTS); $1.80(mf OTS).

Silver plating was investigated as method of preventing corrosion of thorium at temperatures ranging from 300 to 700°C. Plating procedure and results of tensile and fatigue tests of plated specimens are discussed. Investigation of multiple coatings in order to improve the protection is under investigation. (C.H.)

4279 ORNL-93
Oak Ridge National Lab., Tenn.
CORROSION TESTS ON FERRULES FOR TUBE CONNECTIONS IN THE 1300 AREA SEMI-WORKS. A. R. Olsen. July 12, 1948. Decl. Jan. 6, 1956. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The corrosion characteristics of nitrided and work hardened stainless steel ferrules for use in the Parker Ferrulok tube fittings were studied. These tests showed that the nitrided ferrules are not suitable for use with solutions containing nitric acid, and that the work hardened ferrules are not attacked to an appreciable extent. These tests also reaffirmed the fact that stainless steel even in the nitrided condition is not appreciably attacked by strong caustic in concentrations around 4N NaOH. (auth)

4280 ORNL-173
Oak Ridge National Lab., Tenn.
THE CORROSION OF 2S ALUMINUM IN SODIUM BORATE AND LEAD ACETATE SOLUTIONS. James L. English. Oct. 14, 1948. Decl. Jan. 5, 1956. 6p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

Static corrosion tests were conducted with annealed 2S aluminum panels exposed to 5 percent borax solutions and 25 percent lead acetate solutions at room temperature. Corrosion attack was severe in the lead acetate solutions (1.7 mils/month) and less severe in sodium borate solutions (0.31 mils/month). In all cases, corrosion damage appeared to be the result of direct chemical attack and was generally of a uniform nature with very minor localized attack. Water-line attack was studied by partial immersion of the specimens in the corroding media and was of minor consequence in the borax solutions but was very pronounced on the panels immersed in lead acetate. Various organic-type protective coatings were employed to prevent corrosion attack on 2S aluminum by lead acetate solutions. Bakelite lacquer and Pruf-cote were found to be the most resistant. (auth)

4281 ORNL-733
Oak Ridge National Lab., Tenn.
INITIAL CORROSION TESTS ON BRUSH PROCESS QM AND QRM BERYLLIUM. PART I-A. CORROSION OF BERYLLIUM IN SIMULATED COOLING WATER FOR THE MATERIALS TESTING REACTOR. Interim Report [for] April 1949 through September 1949. Arnold R. Olsen. July 14, 1950. Decl. Jan. 6, 1956. 33p. Contract W-7405-eng-26. $6.30(ph OTS); $3.00(mf OTS).

Static corrosion tests were conducted for 60 days in demineralized water containing small amounts of H_2O_2 at 85°C in the pH range 5.5 to 6.5. Samples of QM and QRM Be, produced by two recently developed powder process techniques, were tested The data provided by these experiments indicate that in all cases the metal from these two processes has corrosion resistance comparable with the best vacuum cast and extruded metal tested by this group. QRM metal seems to be slightly superior to the QM metal under all conditions. A calculated maximum penetration rate of 0.0014 in./yr was observed. Data on corrosion of Be–2S Al and Be–356 Al couples are included. Tests are being started to determine the maximum allowable concentration of various ionic constituents in the demineralized water. The results of all tests show that annealing after machining decreases the corrosion resistance of the Be at least in the initial stages of attack. (G.Y.)

4282 ORNL-848
Oak Ridge National Lab., Tenn.
THE CORROSION OF VARIOUS STAINLESS STEELS IN SYNTHETIC WASTE SOLUTIONS. James L. English. Feb. 12, 1951. Decl. Jan. 6, 1956. 25p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

Types 309, 316, and 347 stainless steel were tested for a total of 779 to 828 hr in three different synthetic waste solutions ($TBP-HNO_3-NaNO_3-PO_4^{-}-SO_4^{-}$). The NaCl content of these solutions ranged from 0.007M to 0.028M. The test specimens were checked under conditions of total immersion, liquid-vapor exposure, and exposure to the vapor phase. Tests were run at boiling temperatures. The best all-around corrosion resistance to the test conditions was exhibited by 316 stainless steel, although in one solution 347 stainless steel was slightly more resistant. The tests were run at 105 to 108°C. (G.Y.)

4283 Y-703
Oak Ridge National Lab., Y-12 Area, Tenn.
STAINLESS STEEL COATINGS TO PREVENT THE CORROSION OF COPPER. L. O. Love and W. K. Prater. Jan. 12, 1951. Decl. Jan. 5, 1956. 8p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

In separating the stable isotopes of lithium in the calutron, lithium metal was investigated as a possible charge material. First results indicated that the corrosive action of the hot lithium metal, especially on the copper castings of the source unit, would preclude its use unless some method of protecting the casting could be found. The noncorrosive properties of iron suggested the possibility of coating those source parts affected by the lithium metal with non-magnetic stainless steel. This was tried in the following manner: The charge oven casting and the arc chamber casting were sand blasted and a coat of stainless steel, approximately .015" thick was sprayed on. The effectiveness of this treatment in preventing corrosion of the casting is clearly shown. Out of a total of 100 or more runs in which coated castings were used, no failures occurred due to corrosion of the castings. (auth)

METALS AND METALLURGY

4284 AECD-3794
Knolls Atomic Power Lab., Schenectady, N. Y.
COMPARATIVE BEHAVIOR OF A 1.8 ATOM % CHROMIUM–URANIUM ALLOY AND NORMAL URANIUM ON THERMAL CYCLING. D. W. White. July 14, 1950. Decl. with Deletions Dec. 6, 1955. 14p. Contract W-31-109-eng-52. $0.20(OTS).

A thermal cycling test, consisting of 500 cycles between 100° and 500°C, was conducted on six pairs of 1.8 at. % Cr–U alloy specimens that had been heat treated by isothermal transformation at temperatures varying from 449° to 614°C, an as-alpha-swaged uranium specimen, a uranium specimen that had been quenched from beta, and a uranium specimen that had been quenched from beta and then annealed in high alpha. The chromium alloy was dimensionally stable to 0.1% or less. The heat treated uranium specimens expanded by about 1%, while the as-worked uranium elongated nearly 19%. The chromium alloy retained relatively smooth surfaces, while the uranium specimens roughened as a result of thermal cycling. The slight amount of surface roughening that did occur in the U–Cr specimen group was more prevalent in those specimens that had been transformed at the higher temperatures. Metallographically, the chromium alloy was characterized by more uniform grain size and structure than the heat-treated uranium. Increasing grain refinement was achieved by lowering the temperature of isothermal transformation. Transforming the chrome alloy at 581°C produced a grain size no larger than the maximum grain size of heat treated uranium. Hardness and density measurements were made and data are tabulated. (auth)

4285 AECD-3852
Massachusetts Inst. of Tech., Cambridge.
EXTRUSION AT REVERE COPPER AND BRASS, INC., MARCH 1, 1949. S. V. Arnold. 4p. Decl. Dec. 5, 1955. Contract W-7405-eng-175. (MIT-SVA-18). $1.80(ph OTS); $1.80(mf OTS).

Several samples of cast Be were extruded. Attempts were made to explain the observed ruptures occurring during extrusion. (C.W.H.)

4286 AECD-3857
Tennessee Eastman Corp., Oak Ridge, Tenn.
HIGH TEMPERATURE REFRACTORIES FOR URANIUM. R. L. Hoff, J. W. Sausville, and C. E. Larson. June 3, 1946. Decl. Dec. 22, 1955. 44p. Contract W-7401-eng-23. (C-0.380.6). $7.80(ph OTS); $3.30(mf OTS).

Experiments are described wherein U metal was heated in ten different refractory materials under conditions approximating those of the uranium J. The refractory crucibles containing the uranium were placed in graphite crucibles and heated in vacuo for four hours at 1800 to 1850°C by means of an induction furnace. Magnesium oxide, W, and TiN were found to be unacceptable containers for U at these temperatures. Beryllium oxide, ThO_2, and U showed some reaction with the uranium, whereas UO_2, ZrN, CeS, and ThS were only very slightly affected by the U during the runs. (auth)

4287 AECD-3876
[Massachusetts Inst. of Tech., Cambridge]
BARE BERYLLIUM EXTRUSION USING GRAPHITE INTRODUCTORY CONES. S. V. Arnold. June 28, 1949. Decl. Dec. 8, 1955. 8p. Contract W-7405-eng-175. (MIT-SVA-26). $1.80(ph OTS); $1.80(mf OTS).

4288 AECD-3890
Knolls Atomic Power Lab., Schenectady, N. Y.
EVALUATION OF TYPE 304 STAINLESS STEEL AS A SUBSTITUTE FOR TYPE 347. R. F. Koenig. Nov. 3, 1952. Decl. with deletions Jan. 5, 1956. 18p. Contract W-31-109-eng-52. $3.30(ph OTS); $2.40(mf OTS).

Type 347 stainless steel was selected for SIR applications requiring resistance to corrosion in Na on the basis of limited corrosion data and extrapolation of experience in aqueous media. Subsequent testing indicated that carbide stabilization was not necessary for good resistance to corrosion in Na. Evaluation of the unstabilized grade of 18-8 stainless steel, Type 304, was intensified because if offered a number of advantages over Type 347. Type 304 was more readily available, required fewer strategic materials, was less expensive, and was reported to be weldable with less difficulty. From the results of this investigation, it appears that Type 304 can be submitted for 347 for all SIR applications where the slightly higher elevated temperature strength of 347 is not required. (auth)

4289 CF-51-8-256
Oak Ridge National Lab., Tenn.
LITERATURE SURVEY ON COLUMBIUM. W. C. Hagel. Aug. 21, 1951. Decl. Jan. 4, 1956. 21p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

A literature survey was made of the properties of niobium. Also included are brief discussions of the fabrication of Nb and of the properties of Nb alloys. (B.J.H.)

4290 CF-52-11-7
Oak Ridge National Lab., Tenn.
FABRICATION OF SPHERICAL PARTICLES. E. S. Bomar and H. Inouye. Nov. 1, 1952. Decl. Dec. 22, 1955. 13p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Several techniques for preparation of spherical particles were tried. Of the methods examined, the spray gun, with argon blast substituted for air, gave the most positive results. Primary objection to this method being the large variety of particle sizes obtained and the need for wire stock. Any one of several other methods investigated

might give satisfactory results upon further work or possibly with alloy combinations other than Cu–U, Ni–U, and Mo–U which were used. (auth)

4291 CNL-5

Clinton National Lab., Oak Ridge, Tenn.

SODIUM–RUBIDIUM ALLOYS. John R. Menke. Jan. 8, 1948. Decl. Dec. 21, 1955. 8p. Contract W-35-058-eng-71. $1.80(ph OTS); $1.80(mf OTS).

Attention is directed to the liquid-metal-alloy systems Na–Rb as coolants for piles, especially thermal piles. The reported thermal neutron absorption cross sections of Rb are significantly lower than those for K. Physical contants are collected from the literature which indicate macroscopic physical properties similar to the Na–K alloys. Investigation of the ternary systems Na–Rb–K is suggested. (auth)

4292 CP-1738

[Chicago. Univ.] Metallurgical Lab.

EXPERIMENTS ON THE EVAPORATION OF BORON IN VACUO. Progress Report No. 1 on a Phase of Problem No. 132-ML-56-3. D. D. Friel. Mar. 31, 1944. Decl. Dec. 16, 1955. 14p. Contract [W-7401-eng-37]. (A-2450). $3.30(ph OTS); $2.40(mf OTS).

It was desired to determine a method of evaporating boron to form a rather pure uniform tenacious coat of specified thickness. These coats are needed as monitoring films for neutron intensities, particularly in steel ionization cylinders. The most satisfactory method ov evaporating boron employed a graphite filament. A mixture of amorphous boron and Carbonoid A was painted onto the filament which was then heated by electrical resistance method to 2300°C at which temperature the boron evaporated. Opaque films with purities up to 95% boron or better could be deposited by this method. Much heat was liberated by the filament, and it was found necessary to cool the steel cylinders during evaporation to prevent alloying of boron with the steel. Cathodic deposition also proved satisfactory for producing high purity films; this method has the advantage that little or no heat is produced during the process, but requires much time. The excessive liberation of heat during evaporation is undesirable, particularly since boron forms alloys so readily at abnormal temperature. This liberation of heat can be reduced somewhat by reducing the size of the filaments. Effort will be concentrated to evaporate from smaller sources. To do this, induction heating methods and electron bombardment will be fully explored, and techniques of present methods will be refined. (auth)

4293 CT-1477

Battelle Memorial Inst., Columbus, Ohio.

METALLURGY OF TUBALLOY (URANIUM). Progress Report. Mar. 1, 1944. Decl. Dec. 14, 1955. 36p. Contract [W-7405-eng-92]. (A-2065). $3.30(ph OTS); $2.40(mf OTS).

Dimensional changes in α and through the α-β transition are being studied. The change on passing through the transition appears to be greatly affected by the previous thermal history, as well as by the rates of heating and cooling. The results at present are inconclusive and will be reported at greater length in the next report. Investigation of extrusion at high α temperatures gave successful extrusion at 540 to 650°C at pressures from 70,000 to 120,000 psi on a laboratory press. An attempt to extrude commercially at these temperatures failed because of overheating and possible retention of sufficient β to prevent flow within the press capacity. Extrusion with a similar heating cycle in the laboratory was also unsuccessful. Investigation of the solubility of carbide in the γ region shows solution of carbide in metal of 0.01 to 0.09% C, but solution is incomplete after 96 hours. Quenching appears necessary for retention. (auth)

4294 CT-1937

Battelle Memorial Inst., Columbus, Ohio.

METALLURGY OF TUBALLOY. Progress Report. July 1, 1944. Decl. Dec. 14, 1955. 34p. Contract [W-7405-eng-92]. (A-2820). $6.30(ph OTS); $3.00(mf OTS).

Dilatometric studies have been continued in the high-alpha region, just below the α–β transition. Considerable time was consumed in attempting to minimize oxide formation in the specimen tube for the high-temperature x-ray work. Be was introduced into the Pb–Bi eutectic by using the latter as the cathode in electrolytic reduction of a fused salt bath. Subsequent heating at 500°C appears to permit all the Be to separate in a layer at the top of the melt, indicating negligible solubility at this temperature. A study of the H_3PO_4–HCl acid pretreatment bath for electroplating is in progress. The most satisfactory results have been obtained in baths containing not more than 60% H_3PO_4 and at least 20 cc/liter of HCl at 100°F with a current density of 0.5 amp/in.^{2} for 5 to 10 min. Coating work has been largely on the Al to Al–Si eutectic bond. Slugs of the eutectic jacketed in pure Al show imperfect bonding when heated up to 48 hours at 565°C. New tests on a pure Sn bond between these alloys shows no appreciable diffusion after 150 hr at 190°C, indicating that the previously reported diffusion probably occurred during tinning. Tests on the attack of Al in the Al–Si–Ge alloy at 575°C show less than half the rate of solution of the binary eutectic. Specimens were held in the bath up to one minute at 535°C with negligible attack. Further work on making Be end-cap reinforcements from powder indicates that such a procedure has definite possibilities. Physical tests on α-rolled metal subjected to annealing into the β gives physical properties of the same order as those obtained on similarly treated γ-extruded metal. These results indicate that annealing through the α–β transition may give a standard condition for the metal. (auth)

4295 CT-2400

[Ames Lab., Ames, Iowa]

AIR CORROSION OF THORIUM. Problem Assignment No. 16. J. G. Feibig. Mar. 26, 1945. Decl. Dec. 13, 1955. 11p. Contract W-7405-eng-82. $3.30(ph OTS); $2.40(mf OTS).

A study was made of the corrosion of Th and of a Be–Th alloy in air at various temperatures. Both metals were found to corrode appreciably but the corrosion of the alloy was found to be less than that of the unalloyed Th. A preferential corrosion of one phase of the Be–Th alloy took place, but, owing to a lack of information on the structure of this alloy, the phase most seriously attacked could not be identified. (auth)

4296 CT-2619

[Massachusetts Inst. of Tech., Cambridge].

PROGRESS REPORT FOR MONTH OF DECEMBER 1944. Jan. 6, 1945. Decl. Dec. 15, 1955. 32p. Contract W-7405-eng-175. $6.30(ph OTS); $3.00(mf OTS).

The large magnesia crucibles are in regular production. The scale of operation for Ce sulfide manufacture is

being increased, and methods of control are receiving active study. In the nitride field (TiN, ZrN, TiN–Ce_2S_3, and ThN–ZrN), efforts are being directed toward greater densification of the crucibles by means of addition agents and higher firing temperatures. It now appears that carbon exerts an important influence on the formation of the epsilon phase in U–Si alloys. From a corrosion standpoint, epsilon does not exhibit as much of an advantage over pure U in distilled water at 70°C as in boiling distilled water containing 5 ppm of chloride. Further information is available on the U–Zr, U–Pd and U–Ce systems. Improved results have been obtained with graphite molds for Be castings, but metal molds still seem desirable. Recrystallization phenomena in Be have been studied as a function of time and temperature. (auth)

4297 CT-2717
Ames Lab., Ames, Iowa.
THE TUBALLOY–THORIUM BINARY SYSTEM. Problem Assignment No. 10. O. N. Carlson and A. H. Daane. Apr. 27, 1945. Decl. Dec. 16, 1955. 12p. Contract W-7405-eng-82. $3.30(ph OTS); $2.40(mf OTS).

An investigation of the Th–U system has been completed, and a constitutional diagram has been drawn up. A simple eutectic exists with complete miscibility in the liquid state and complete heterogeneity in the solid state. No intermetallic compound was found nor was there any evidence of solid solubility of one component in the other. The Th-rich liquidus was not located. (auth)

4298 CT-2780
[Massachusetts Inst. of Tech., Cambridge]
PROGRESS REPORT FOR MONTH OF FEBRUARY 1945. Mar. 6, 1945. Decl. Dec. 15, 1955. 46p. Contract W-7405-eng-175. $7.80(ph OTS); $3.30(mf OTS).

The large magnesia crucibles are being manufactured on a regular schedule with very little loss in process. Kiln firing is used for this production. Low porosity crucibles in small sizes can now be made of magnesia, beryllia, thoria, Ti nitride, and Zr nitride. High Ce sulfide is being turned out on a substantial scale in the enlarged set-up. H_2S is the sulfurizing agent, and the carbon content of the product is low. The low Ce sulfide crucibles are being manufactured and shipped regularly, but a better understanding of some of the processing factors seems desirable. The epsilon phase in the U–Si system forms via a peritectoid reaction at 940°C if the carbon content is low. As the carbon increases up to 0.13 wt.%, the epsilon formation temperature is progressively lowered to 850°C. Epsilonized alloys with as little as 15 at.% Si are not seriously corroded in distilled water at 70° and 100°C even when oxygen or hydrogen is added to the water. Precision lattice measurements on U metal have given parameter values of a_0 = 2.8482 A, b_0 = 5.8565 A, and c_0 = 4.9476 A with a theoretical density of 19.050 g/cc. The melting point of U is raised to about 1220°C by the addition of 20 at.% Zr. The solidus for a 40 at.% alloy appears at 1250°C. Methods for vacuum casting of large Be shapes were studied. A satisfactory solution of the mold problem was not attained. Be alloys with 0.5 wt.% of Al, Zr, and Ti were prepared. (auth)

4299 CT-3013
[Chicago. Univ. Metallurgical Lab.]
THE TUBALLOY–NICKEL PHASE DIAGRAM. Final Report on Part I of P. A. No. 381-ML-54-3. Frank Foote, J. R. Clark, M. Cieslicki, B. J. Nelson, and J. R. Lane. May 7, 1945. Decl. Dec. 15, 1955. 22p. Contract W-7401-eng-37. $6.30(ph OTS); $3.00(mf OTS).

The complete Ni–U constitutional diagram has been determined. Thermal analyses data are reported, and numerous microstructures are illustrated. 32 figures. (G.Y.)

4300 CT-3060
Massachusetts Inst. of Tech., Cambridge.
PROGRESS REPORT FOR MONTH OF MAY 1945. June 7, 1945. Decl. Dec. 27, 1955. 28p. Contract W-7405-eng-175. $4.80(ph OTS); $2.70(mf OTS).

Progress is reported in the production of large magnesia crucibles, dense magnesia crucibles, sulfide crucibles for Be melting; the extrusion of Be billets; studies of tensile properties of extruded and annealed Be; the corrosion of Si–U alloys and of U–Zr alloys in boiling water; and the creep of U at various temperatures. (C.H.)

4301 CT-3563
Massachusetts Inst. of Tech., Cambridge.
PROGRESS (A-1) REPORT FOR MONTH OF MAY 1946. June 14, 1946. Decl. Dec. 15, 1955. 27p. Contract W-7405-eng-175. $4.80(ph OTS); $2.70(mf OTS).

Progress is reported in the following studies: the casting and distillation of Be; the effects of extrusion temperature, heat treatment, and Al additions on the tensile properties of pure Be and Al–Be alloys; and the preparation of Be tubing by extrusion. (C.H.)

4302 HW-12637
Hanford Works, Richland, Wash.
AUSTENITIC WELDS–CORROSION RESISTANCE AND MAGNETIC SUSCEPTIBILITY. W. W. Koenig and R. L. Heckman. Mar. 7, 1949. Decl. Dec. 28, 1955. 3p. Contract [W-31-109-eng-52]. $1.80(ph OTS); $1.80(mf OTS).

Austenitic stainless steel (T-347) welds were found during building construction which exhibited what was thought to be an unusual attraction for a magnet. The effect, if any, of this magnetic property was investigated. On the basis of the tests described, the corrosion characteristics of T-347 welded stainless steel were found not to be effected by the magnetic properties of the welds even though these properties are likely the result of the presence of the ferritic structure. (auth)

4303 HW-27207
Hanford Works, Richland Wash.
RESULTS OF SURVEY OF ALUMINUM ALLOYS FOR PROCESS TUBE AND CAN APPLICATION. A. T. Taylor. Feb. 20, 1953. Decl. Dec. 8, 1955. 6p. $1.80 (ph OTS); $1.80(mf OTS).

The aluminum alloy (63S) was selected from tests in which a search was made for an alloy exhibiting improved strength and corrosion resistance while maintaining a satisfactory nuclear cross section. The corrosion data on this and several other Al alloys in pile process water are given. (L.M.T.)

4304 ISC-48
Ames Lab., Ames, Iowa.
THORIUM ALLOYS — THE THORIUM–BISMUTH SYSTEM. Harlan B. Johnson. July 12, 1950. Decl. Jan. 5, 1956. 18p. Contract W-7405-eng-82. $3.30(ph OTS); $2.40(mf OTS).

The portions of the equilibrium between Th and Th_2Bi and between $ThBi_3$ and Bi have been established. Preparation of the alloys by co-reduction and attempted preparation by treatment of Th with molten Bi and by annealing of powder

mixtures are described, and photomicrographs of various alloy compositions are shown. (G.Y.)

4305 ISC-82
Ames Lab., Ames, Iowa.
PROGRESS REPORT IN METALLURGY, OCTOBER 1, 1949 TO MARCH 31, 1950. B. A. Rogers. May 15, 1950. Decl. Jan. 6, 1956. 30p. $4.80(ph OTS); $2.70(mf OTS).

Progress is summarized on preparation of ThS_2, production of Ca and Zr, casting and fabrication of Zr, and phase studies of the Zr–U, Zr–Th, U–Th, Zr–Nb, Zr–Cu, Zr–Sn, and Th–C alloys. Modifications in apparatus to measure the electrical resistance of Th and Th alloy bars are described. (G.Y.)

4306 ISC-113
Ames Lab., Ames, Iowa.
QUARTERLY SUMMARY RESEARCH REPORT FOR APRIL, MAY AND JUNE 1950. W. E. Dreeszen. Aug. 15, 1950. Decl. Jan. 5, 1956. 37p. Contract W-7405-eng-82. $6.30 (ph OTS); $3.00(mf OTS).

Progress is reported on the following studies: the preparation of Ca by reduction of lime with Al; the preparation of Zr; x-ray-diffraction studies on Zr–U alloys; the separation of rare earths by ion exchange; the radioactivities of isotopes of Ge, As, Ga, and Zn; coincidence counting of Yb^{169}; the formation of Co^{58} and Co^{58m} by (γ,n) reactions during synchrotron irradiations of Co^{59}; the operation of the synchrotron; the preparation of Th from monazite; the leaching of Th from slag; and the preparation of Hf. (C.H.)

4307 ISC-128
Ames Lab., Ames, Iowa.
PROGRESS REPORT IN METALLURGY [FOR] APRIL 1, 1950 TO SEPTEMBER 30, 1950. B. A. Rogers. Nov. 10, 1950. Decl. Jan. 5, 1956. 41p. Contract W-7405-eng-82. $6.30(ph OTS); $3.00(mf OTS).

Progress is reported in the following studies: the distillation and preparation of Ca; the preparation, casting, and fabrication of Zr; the preparation of consumable electrodes; corrosion of Zr and Zr alloys; the preparation of V by fused salt electrolysis; and the preparation and properties of alloys of U–Zr, Th–Zr; Nb–Zr, Sn–Zr, Al–Zr, Ge–Zr, and Th–U, and C–Th systems. Constitution diagrams are presented for the C–Th system and Th–Zr, Sn–Zr, and Th–U alloys. (C.H.)

4308 ISC-132
Ames Lab., Ames, Iowa.
SOME INVESTIGATIONS INTO ZIRCONIUM ALLOY SYSTEMS. B. A. Rogers and P. Chiotti. Nov. 28, 1950. Decl. Jan. 6, 1956. 64p. Contract W-7405-eng-82. $10.80(ph OTS); $3.90(mf OTS).

A series of individual reports on the binary alloy systems of Zr with Al, Sb, Bi, C, Cu, Ge, Nb, Th, Sn, and U is presented. The available thermal, microscopic, x-ray-diffraction, hardness, and corrosion data are given. Some qualitative data on corrosion of miscellaneous alloys with Cr, Pt, Pd, V, and Mo is appended. (L.M.T.)

4309 ISC-208
Ames Lab., Ames, Iowa.
PROGRESS REPORT OF AN INVESTIGATION OF THE PROPERTIES OF THORIUM AND SOME OF ITS ALLOYS. G. C. Danielson, Glenn Murphy, D. Peterson, and B. A. Rogers. Feb. 1, 1952. Decl. Dec. 5, 1956. 35p. Contract W-7405-eng-82. $6.30(ph OTS); $3.00(mf OTS).

A detailed report is made on the progress of the work on the physical and mechanical properties of Th and Th alloys and their preparation. (J.E.D.)

4310 ISC-213
Ames Lab., Ames, Iowa
PROGRESS REPORT OF AN INVESTIGATION OF THE PROPERTIES OF THORIUM AND SOME OF ITS ALLOYS. G. C. Danielson, Glenn Murphy, D. Peterson, and B. A. Rogers. Mar. 1, 1952. Decl. Jan. 5, 1956. 30p. Contract W-7405-eng-82. $4.80(ph OTS); $2.70(mf OTS).

Progress is reported on the preparation of Th and Th alloys, and an investigation of mechanical and physical properties of Th and Th alloys. (C.H.)

4311 ISC-299
Ames Lab., Ames, Iowa.
QUARTERLY SUMMARY RESEARCH REPORT IN CHEMISTRY FOR JULY, AUGUST AND SEPTEMBER 1952. Dec. 1, 1952. Decl. Jan. 7, 1956. 26p. Contract W-7405-eng-82. $4.80(ph OTS); $2.70(mf OTS).

Progress is briefly reported on the following studies: separation of rare earths by ion exchange, melting points and solid transition temperatures of rare earths, heats of solution and formation of rare earth chlorides, adsorption from solution, mechanism of Zn reduction, the Ce(IV)-chloride reaction, titration of Th, and irradiation of Au and Os. (L.T.W.)

4312 ORNL-704
Oak Ridge National Lab., Tenn.
INVESTIGATION OF ROLLING PROPERTIES AND CORRELATED MICROSTRUCTURES OF ZIRCONIUM PRODUCED BY THE MATERIALS LABORATORY AT Y-12 AREA. D. E. Hamby and R. J. Gray. Aug. 24, 1950. Decl. Jan. 6, 1956. 18p. Contract W-7405-eng-26. $3.30 (ph OTS); $2.40(mf OTS).

Preliminary experiments indicate that Ca-reduced Zr substantially free of Si may be cold rolled after the cast structure is broken up by hot forging. Control specimens of Bureau of Mines and crystal-bar Zr indicate that the Ca-reduced metal does not compare favorably with crystal-bar metal in rolling properties but may be comparable to Bureau of Mines material after contamination by repeated melting in graphite. (G.Y.)

4313 ORNL-833
Oak Ridge National Lab., Tenn.
ELECTRODEPOSITION OF ALUMINUM AND ZIRCONIUM ON URANIUM. M. H. Lietzke. Oct. 12, 1950. Decl. Jan. 7, 1956. 8p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

A method has been found for the electrodeposition of adherent deposits of both Al and Zr on U. The plating baths consist of Al bromide or Zr tetrachloride dissolved in fused ethyl pyridinium bromide. The current efficiencies are extremely good for Al deposition but low for the Zr bath. (auth)

4314 ORNL-920
Oak Ridge National Lab., Tenn.
MERCURY AMALGAM BONDING OF URANIUM AND COPPER. Period Covered July 1950–November 1950. L. G. Glasgow. Jan. 22, 1951. Decl. Jan. 5, 1956. 22p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

Data are presented relating strength of Ag–Hg bonds between U and Cu, Cu and Cu, and Cu and Ag to bonding time and temperature. Bonding time was varied from ½

hour to 6 hours; temperature was varied from 350°C to 550°C. In general strength increased with increasing bonding time and with increasing temperature. Machined U samples were compared to as-rolled U samples, machined samples gave superior strength values. (auth)

PHYSICS

4315 AECD-3802

Tennessee Eastman Corp., Oak Ridge, Tenn.

OHMIC CHARACTERISTICS OF HIGH MEGOHM RESISTORS. A. E. Cameron and J. R. White. Apr. 3, 1946. Decl. Nov. 28, 1955. 14p. Contract [W-7401-eng-23]. (B-6.460.13). $3.30(ph OTS); $2.40(mf OTS).

Methods for determining the polarization characteristics of high megohm resistors are discussed. The suitability of resistors for spectrometric measurements may be determined by these methods. A selected resistor was calibrated against a condenser electrometer and was then used as a standard in the voltage range 0.050 to 1 volt for the calibration of other resistors. The current ratios established by resistor measurements are shown to be identical with those determined by rate-of-charge measurements within the error of comparison of 0.2%. Certain resistors show linearity departures below 0.050 volt which may amount to 1% at 0.020 volt. These deviations appear in the direction of lower resistance and appear to correlate with polarization behavior. (auth)

4316 AECD-3819

Tennessee Eastman Corp., Oak Ridge, Tenn.

VACUUM PROBE, STANDARD LEAKS, AND NEEDLE VALVE FOR USE WITH THE HELIUM LEAK DETECTOR. A. J. Samuel. Aug. 16, 1945. Decl. Nov. 28, 1955. 11p. (D-4.440.1). $3.30(ph OTS); $2.40(mf OTS).

Part I of this report deals with the development and use of a vacuum probe for leak hunting with the Helium Leak Detector. Part II describes two types of Standard Leaks, one adjustable, the other fixed, which were designed for measuring the sensitivity of the Helium Leak Detector by the two leak method. Both types have been proved satisfactory in laboratory and plant tests. Part III deals with the development of a needle valve with fine adjustment for controlling the flow of a standard mixture of helium and air into the leak detector for a sensitivity check by the single leak method. Part IV describes a worm and gear adjustment developed for use with the $\frac{3}{8}''$ Kerotest angle valve to facilitate throttling of the Helium Leak Detector on a vacuum header equipped with this valve. (auth)

4317 AECD-3820

Tennessee Eastman Corp., Oak Ridge, Tenn.

ABRASIVE BLASTING FOR CLEANING PARTS. (Experiment Performed August 18 Through August 25, 1945). Jack R. McWherter and Stephen Yerazunis. Sept. 7, 1945. Decl. Nov. 28, 1955. 10p. (D-4.340.2). $1.80(ph OTS); $1.80 (mf OTS).

A demonstration showed that Alpha or Beta M or E parts, including insulators, can be well cleaned with a pressure-feed abrasive blaster. The abrasive is a slurry of alumina and water mixed high velocity air in a special feed nozzle. The slurry is continuously recycled. (auth)

4318 ANL-4010

Argonne National Lab., Lemont, Ill.

EXPERIMENTAL NUCLEAR PHYSICS DIVISION AND THEORETICAL NUCLEAR PHYSICS DIVISION REPORT FOR APRIL, MAY AND JUNE 1947. July 14, 1947. Decl. Dec. 15, 1955. 112p. Contract W-31-109-eng-38. $18.30 (ph OTS); $6.00(mf OTS).

The evolution of H_2 from neutron-irradiated LiH was observed. Mechanical and electrical improvements were made on the reactor oscillators. A value of $\sigma = 0.4$ barns was obtained for the $N^4(n,p)C^{14}$ reaction based on C^{14} half life ~5000 yr. Annular ion chambers containing BF_3 were used for neutron scattering measurements on Mn, Co, and Cu. The measured Q values of the (n,p) reactions for He^3 and N^{14} were 740 and 597 kev, respectively. Transport cross sections of BeO were investigated. Results indicate that the delayed neutron yield from U^{235} does not change with incident neutron energy. The neutron cross sections of graphite, Al, Be, BeO, and In were measured. Radioactivity was induced in Sb, Dy, and Se by neutron irradiation. Angular distribution of particles in a nuclear reaction, binding energy or triton, and transient behavior of fast reactors were investigated. (C.W.H.)

4319 CP-3750

Argonne National Lab., Lemont, Ill.

EXPERIMENTAL NUCLEAR PHYSICS DIVISION AND THEORETICAL NUCLEAR PHYSICS DIVISION REPORT FOR OCTOBER, NOVEMBER, AND DECEMBER 1946. Jan. 17, 1947. Decl. Dec. 20, 1955. 125p. Contract W-31-109-eng-38. $19.80(ph OTS); $6.30(mf OTS).

Experimental data obtained on the following experiments are summarized: pile-oscillator studies of the effect of neutron scattering in epi-cadmium neutron measurements in the CP-3 thimble, fast neutron effect in Bi and Pb, test of purity of NaK, resonance integrals of pure Na and K, thermal absorption by Zr, cadmium ratio in large Pb and graphite cubes, and resonance scattering in Mn; neutron scattering by paramagnetic substances ($MnSO_4$, $KMnO_4$, MnS, MnO_2, and MnO); half life of Be^{10}; fast neutron capture cross section of Ba^{138}; Na(n, 2n) reaction; BeO moderation properties; total cross sections of Nd, Dy, Fe, Pb, and Bi; isomeric transition and other radioactivity properties of Ir^{192}, Nb^{94}, Eu isotope, long lived Nd, and Se ^{83}; neutron diffraction by $SrSO_4$ and Al_2O_3; neutron scattering in gaseous CF_4; residual cross section of Be, Bi, Al, and Pb filters; and Breit-Wigner resonances in In and Ag. Most of this work has been published or superseded. Theoretical work reported includes a rather complete analysis of the inelastic scattering problem for polycrystals which can be approximated by Einstein or Debye models, the results being most useful in the fast neutron region. Neutron scattering cross sections for Be, BeO, and graphite are calculated. (G.Y.)

4320 Y-317

Carbide and Carbon Chemicals Corp. Y-12 Plant, Oak Ridge, Tenn.

A COMPARISON OF THE OPERATIONAL CHARACTERISTICS OF A CALROD HEATER IN VACUUM AND ATMOSPHERIC PRESSURE. S. D. Fulkerson and F. J. Lambert. Nov. 10, 1948. Decl. Dec. 6, 1955. 18p. Contract W-7405-Eng-26. $0.20(OTS).

An experiment was run to determine the operational characteristics of a calrod heater in vacuum in order to

compare these results with those obtained with a similar heater operating at atmospheric pressure, and to determine what precautions should be observed in design and operation of such heaters. To achieve this objective the difference between sheath and filament temperatures (ΔT) was measured at various wattage inputs. Results show that ΔT resulting from a given power input is greater in vacuum than it is in air and destructive temperatures are reached at lower power input. (auth)

GASES

4321 ORNL-282
Oak Ridge National Lab., Tenn.
AN EXPERIMENTAL STUDY OF THE HILSCH TUBE AND ITS POSSIBLE APPLICATION TO ISOTOPE SEPARATION. W. G. Stone and T. A. Love. Jan. 4, 1950. Decl. Jan. 6, 1956. 43p. Contract W-7405-eng-26. $7.80(ph OTS); $3.30(mf OTS).

It has been found experimentally that a separation of the components of a mixed gas can be obtained by the use of a modified Hilsch tube. This separation is a function of two or more effects which interact in such a manner that variations in adjustments determine whether or not separation does occur, and if so, which of the fractions, light or heavy, is concentrated in the hot exit stream. Observations made with many modifications in design are consistent with the belief that the separation is a function of both centrifugal force and of regenerative diffusion of a special kind across a boundary maintained by the centrifugal force. The separations definitely established at this time are small but there appears reason to believe that these can be greatly increased. All of the models which were tested were designed to determine the principles of operation, primarily by means of temperature measurements since these can be made easily and continuously. The more difficult tests of separation were done to test a tentative theory of the mode of operation which was arrived at as the result of temperature measurements and visual observations. The results of the tests for separation were consistent with the theory. (auth)

4322 ORNL-793
Oak Ridge National Lab., Tenn.
DECONTAMINATION OF XENON FROM RADON. H. Zeldes and A. R. Brosi. Aug. 14, 1950. Decl. Jan. 5, 1956. 9p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

The feasibility of rapidly decontaminating liter amounts of Xe from Rn by factors of at least 10^6 using a simple gas chromatography technique has been demonstrated. The separation has been achieved in a single pass through a small synthetic hydroxyapatite column with high recovery. A method is also indicated for quantitatively recovering the Xe in a given sample in decontaminated form. (auth)

INSTRUMENTS

4323 AECD-3780
Tennessee Eastman Corp., Oak Ridge, Tenn.
HIGH VOLTAGE RECTIFICATION. Walter H. Nelson. Apr. 13, 1945. Decl. Nov. 28, 1956. 4p. (MXL-WHN-10). $1.80(ph OTS); $1.80(mf OTS).

The use of kenotrons and associated circuitry in high-voltage rectification is briefly discussed. (B.J.H.)

4324 AECD-3781
Tennessee Eastman Corp., Oak Ridge, Tenn.
A NEW TYPE REGULATOR FOR HIGH VOLTAGE SUPPLIES. E. J. Groth, Jr. [194?]. Decl. Nov. 29, 1955. 4p. (TE-B-3-1). $1.80(ph OTS); $1.80(mf OTS).

A schematic diagram is given of a voltage regulator designed to meet the stability and short-time requirements for the regulation of a continuously variable voltage source from 1600 to 4000 volts. Its operating characteristics are discussed in some detail. (B.J.H.)

4325 AECD-3823
Tennessee Eastman Corp., Oak Ridge, Tenn.
DIRECT-READING INTEGRATOR. V. B. Waithman, K. G. Macleish, and H. B. Frey. Mar. 7, 1945. Decl. Nov. 29, 1955. 6p. (D-Special 38). $1.80(ph OTS); $1.80(mf OTS).

An instrument is described which makes use of a standard watthour meter in conjunction with an amplifier to register the time integral of a varying voltage. When a suitable current shunt is used as the input element, the instrument becomes a direct-reading coulombmeter. In any of its applications the instrument is accurate to ± 2%. (auth)

4326 AECD-3824
Tennessee Eastman Corp., Oak Ridge, Tenn.
STABILIZER FOR TEMPERATURE CONTROL EQUIPMENT. K. G. Macleish and R. C. Palmer. May 14, 1945. Decl. Nov. 28, 1955. 7p. (D-Special 44). $1.80(ph OTS); $1.80(mf OTS).

A simple electronic circuit is described, the use of which greatly improves the temperature regulation obtainable with Beta equipment. The circuit utilizes the time derivative of the temperature to counteract oscillation and overshoot. No other changes are required in existing equipment for installation of the stabilizer. Attachment of the stabilizer to Beta temperature control circuits which previously showed oscillation has resulted in a reduction of the amplitude of the oscillation by a factor of ten. In units where no oscillation is present at a given band width, the stabilizer permits operation at a much narrower band width without incurring instability. (auth)

4327 AECD-3895
Knolls Atomic Power Lab., Schenectady, N. Y.
CONSTRUCTION, OPERATION AND USE OF KAPL URANIUM FLUORIMETERS. B. F. Rider. Oct. 7, 1948. Decl. with deletions Jan. 9, 1956. 18p. Contract W-31-109-eng-52. $3.30(ph OTS); $2.40(mf OTS).

4328 AECD-3992
National Lead Co. of Ohio, Cincinnati.
UF_6 DETECTOR. W. E. Shaw and J. R. Dearwater. Nov. 24, 1954. Decl. with deletions Dec. 1, 1955. 9p. Contract AT(30-1)-1156. $1.80(ph OTS); $1.80(mf OTS).

A simple detector for determining the presence of UF_6 in a stream of HF, UF_4, and dissociated NH_3 is described. The basic detection element is a sensitized piece of carbon rod. The unit has proved satisfactory on production equipment. (auth)

4329 AECD-4002
Kellex Corp., New York.
FEASIBILITY OF AN ELECTRO-MAGNETIC METHOD OF INTERFACE LEVEL MEASUREMENT. David J. Anthony. Aug. 13, 1948. Decl. Jan. 6, 1956. 30p. (INDC-1724). $4.80(ph OTS); $2.70(mf OTS).

In a search for a method superior to the air-bubbler method for measurement of liquid and interface levels, the electrical-induction method was examined. Preliminary tests were made by detecting the position of a soft Fe float in a stainless steel column by means of a bridge circuit of four pancake coils mounted against the outside of the column. This being successful, an Fe-cored bridge was developed which produced the same magnitude of displacement signals while using only 0.01 of the input wattage. Results showed the method to be feasible. Circuit diagrams, sketches, and calibration graphs of the apparatus are presented. (L.M.T.)

4330 HW-13134
Hanford Works, Richland, Wash.
OPTICAL INSTRUMENTS FOR THE ATOMIC INDUSTRY. J. M. Holeman. [nd.] Decl. Dec. 22, 1955. 24p. Contract [W-31-109-eng-52]. $4.80(ph OTS); $2.70(mf OTS).

General descriptions and engineering problems of instruments which permit observation of radiation experiments without danger to the observer are discussed. These instruments include viewers with H_2O shielding, reflecting viewers, periscopes, boroscopes, binocular periscopes, and stereoscopic periscopes. (B.J.H.)

4331 Y-734
Oak Ridge National Lab., Y-12 Area, Tenn.
HIGH INTENSITY ION SOURCE FOR N^{+++}. R. J. Jones and A. Zucker. Mar. 1, 1951. Decl. Jan. 5, 1956. 10p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

Designs are given for a hot-cathode type ion source used for the production of relatively high currents of multiply charged N ions. The apparatus for the measurement of multiple ionization of N is shown, and data are also given on the ion output as a function of the arc voltage. (B.J.H.)

ISOTOPES

4332 AECD-3983
Clinton National Lab., Oak Ridge, Tenn.
PREPARATION OF RADIOIRON OF HIGH SPECIFIC ACTIVITY. J. A. Swartout and H. M. Rice. Jan. 28, 1948. Decl. with deletions Dec. 2, 1955. 32p. Contract W-35-058-eng-71. $6.30(ph OTS); $3.00(mf OTS).

A comparison was made of methods for producing Fe^{59} of higher specific activity than that obtainable by irradiating natural iron in the Clinton pile. Five processes were considered irradiation of natural iron in the Hanford piles, irradiation of enriched Fe^{58} in the Clinton and Hanford piles, Szilard-Chalmers enrichment using ferrocyanides in the Clinton pile, collection of recoils in a phase separable from the bulk of the iron, and the Co^{59} (n,p) Fe^{59} reaction in the Clinton and Hanford piles. From a knowledge of the Clinton and Hanford neutron fluxes, the enrichment of Fe^{58} achievable at Y-12, the yield of the Co (n,p) process, experimental results for Szilard-Chalmers enrichment obtained previously and in this study, and from measurements of the fraction of Fe^{59} collectable as recoils served conclusions were reached. (auth)

ISOTOPE SEPARATION

4333 AECD-3834
Tennessee Eastman Corp., Oak Ridge, Tenn.
THE THERMOCHEMICAL PROCESS OF METAL TRANSFER. C. R. McKinney. May 1946. Re-issued May 2, 1947. Decl. Jan. 4, 1956. 13p. Contract W-7401-eng-23. (D-4.250.31). $3.30(ph OTS); $2.40(mf OTS).

The process by which the insulators used in the calutron acquire a conducting coating has been investigated and found to be a thermochemical process. The metal of the insulator shield reacts with the halide atmosphere of the calutron and forms volatile salts which vaporize and then condense upon the cooler surface of the insulator. All common metals have been shown to react with a chlorine atmosphere at temperatures from 200 to 700°C. The presence of copper chloride has been shown to accelerate the rate of reaction of other metals. Studies indicate that it will not be possible to construct successful metal insulator shields to be used in the halide atmosphere of the calutron without water cooling. (auth)

4334 Y-660
Oak Ridge National Lab., Y-12 Area, Tenn.
ENRICHMENT OF URANIUM 234. B. Harmatz and R. S. Livingston. Sept. 1, 1950. Decl. Jan. 6, 1956. 39p. Contract W-7405-eng-26. $6.30(ph OTS); $3.00 (mf OTS).

Magnetic separation of U to achieve high purity U^{234} is described. Innovations included multiple stage operation, processing of small quantities of feed, and control of the inhalation hazard from alpha-active U^{234}. Starting with one per cent U^{234} concentration, a two-stage separation program yielded 1.5 grams of U averaging 94 per cent U^{234}. This result was obtained through a $U^{234}-U^{235}$ enrichment factor of 36 at a U^{234} process efficiency of 9 per cent. (auth)

4335 Y-748
Oak Ridge National Lab., Tenn.
MATHEMATICAL SURVEY OF A MAGNETIC CENTRIFUGE FOR ISOTOPE SEPARATION. P. F. Dunn. Feb. 23, 1951. Decl. Jan. 6, 1956. 46p. Contract W-7405-eng-26. Charge $7.80(ph OTS); $3.30(mf OTS).

It is suggested that, in a magnetic centrifuge, two different mass species should experience opposite directional effects, thus giving very high enrichments with few stages of processing. A complete mathematical analysis is given of the operation of such a centrifuge, which operates on the principle that if a magnetic field is applied antiparallel to the angular velocity of the centrifuge, ions of different weights will diffuse in different directions. Calculations are also made for the case where the centrifuge is applied to the separation of an aqueous solution of Li^7Cl and Li^6Cl. (B.J.H.)

MASS SPECTROGRAPHY

4336 AECD-4000
Tennessee Eastman Corp., Oak Ridge, Tenn.
THE ION VELOCITRON. A. E. Cameron and D. F. Eggers. Jan. 27, 1947. Decl. Nov. 29, 1955. 14p. (B-6.480.1). $3.30(ph OTS); $2.40(mf OTS).

A very rapid method for the identification of isotopes in a system which changes as a function of time was developed. Non-magnetic means were possible by introducing a pulse of ions into a drift tube, accelerating them electrostatically, and measuring the resultant differences in arrival time at the end of the tube. An important limitation of the device is due to the source which produces non-monoenergetic ions and consequently an undesirable pulse width. (K.S.)

4337 CF-51-5-170
Oak Ridge National Lab., Tenn.
RC-542 CONSUMPTION OF REFRIGERANT FOR OFF-GAS SYSTEM (Liquid Nitrogen Unit). P. J. Falivene. May 29, 1951. Decl. Dec. 21, 1955. 15p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The consumption of refrigerant by the liquid nitrogen unit used for cooling mass spectrometers was calculated. Operational and heat loading conditions are reviewed. Data are presented graphically on the total liquid N production to meet requirements under the conditions specified. (C.H.)

4338 K-558
Carbide and Carbon Chemicals Div. K-25 Plant, Oak Ridge, Tenn.
A SOURCE MAGNET ASSEMBLY FOR THE LINE RECORDER MASS SPECTROMETER METAL TUBE. R. D. High. Jan. 19, 1950. Decl. Jan. 3, 1956. 12p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

The difficulty encountered in adjusting the line recorder source magnet for maximum trap current and the shifting of the magnet assembly in transportation caused an investigation to be made for a method of remedying the source magnet adjustment problem. Work on different methods of mounting the source magnet on the metal tube and an investigation of the strength and position of the magnets revealed that if the gap between the poles be reduced, fewer adjustments would be required. The magnet assembly could be attached to the metal tube assembly in a predetermined fixed position with relation to the source. The assembly improved the trap current and permitted the tube rack to be transported from shop to field without shifting the source magnet position. (auth)

4339 Y-762
Oak Ridge National Lab., Tenn.
THE METAL CARBONYLS AS SOURCES OF POSITIVE IONS. L. O. Gilpatrick and Russell Baldock. May 16, 1951. Decl. Jan. 5, 1956. 19p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

The volatile metal carbonyls as sources of positive ions are reviewed and the results of ionization studies are cited to show that the yield of the singly charged metal ion is large. This high ionization efficiency gives rise to efficient operation in the mass spectrometer or calutron. Two general methods of synthesizing the metal carbonyls are described and specific techniques for synthesis of the carbonyls of Cr, Mo, W, Ru, and Os are presented. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

4340 A-3209
Columbia Univ., New York. Pupin Physics Labs.
IMPROVED TECHNIQUE OF HYDROGEN CONTENT ANALYSIS BY SLOW NEUTRON SCATTERING. L. J. Rainwater and W. W. Havens, Jr. Feb. 28, 1945. Decl. Jan. 18, 1956. 20p. Contract W-7405-eng-50. (DR-64). $3.30(ph OTS); $2.40(mf OTS).

A slow-neutron-transmission method for determining the H content of fluorocarbons is described. (G.Y.)

4341 AECD-4022
Hanford Works, Health Instruments Div., Richland, Wash.
RESULTS OF SOME STATISTICAL TESTS OF PARTICLE DETECTORS. W. R. Portch and G. H. Whipple, Jr. July 1948. Decl. Nov. 29, 1955. 30p. Contract [W-31-109-eng-52]. (HWR-11035). $4.80(ph OTS); $2.70(mf OTS).

The question considered is the need for more complete statistical analysis of particle detector performance, with particular reference to hand and foot counters, than is now conducted. Four experimental investigations were carried out: (1) five-fold hand and foot counter; (2) neutron counter, BF_3; (3) mica window set (BGO); and (4) thin window glass (TWG) GM tube. The results show that the five-fold hand and foot counters and the mica window sets do not demonstrate statistically acceptable behavior. It has been shown, however, that the additional time and effort necessary to obtain data which will yield standard deviation or some other measure of dispersion is not warranted in the case of any combination of a scaler with one or more TWG GM tubes as they are now used at the Hanford Works. The necessity for more elaborate statistical tests than those now used for analytical counters or for calibration procedures has not been indicated by this work. (G.Y.)

4342 AECD-4024
Mound Lab., Miamisburg, Ohio.
GENERAL RESEARCH REPORT FOR DECEMBER 26, 1950 TO APRIL 16, 1951. May 21, 1951. Decl. with deletions Jan. 11, 1956. 47p. Contract AT-33-1-gen-53. $7.80(ph OTS); $3.30(mf OTS).

The design of a non-linear, high-gain, wide-dynamic-range amplifier for improved neutron counting is reported. Electronic circuits for a fast-neutron survey meter and a stable energy-independent γ monitor are presented. A mechanical integrator for low counting rates in air monitoring is described. Adsorption studies are reported on a Nuclear Instruments PC-1 (Bradley) counter. The design and operation of a standard-torsion, equal-arm, quartz-fiber microbalance are discussed. (G.Y.)

4343 CF-52-10-9
Oak Ridge National Lab., Tenn.
SUMMARY OF LID TANK NEUTRON DOSIMETER MEASUREMENTS IN PURE WATER. T. V. Blosser and C. E. Clifford. Oct. 1, 1952. Decl. Dec. 16, 1955. 13p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

In fast-neutron-dosage measurements made in the Lid Tank over a $1\frac{1}{2}$-yr period, care was taken to minimize γ-radiation effects on the counter by biasing out the counts from gammas for a 17 r/hr dose and by taking measurements with pile power lowered from 3600 to 2100 kw. Data are given and comparison is made with the BSF measurements. The Lid Tank dosage measurements appear to be about 3% greater than the BSF measurements. (L.M.T.)

4344 HW-28263
Hanford Atomic Products Operation, Richland, Wash.
THE USE AND CALIBRATION OF SCINTILLATION COUNTER–MODEL V. F. P. Brauer and M. B. Laboeuf. Aug. 1, 1953. Decl. Jan. 6, 1956. 28p. Contract [W-31-109-eng-52]. $4.80(ph OTS); $2.70(mf OTS).

Several improvements were made in the gamma scintillation counter (GSC). The Model V gamma scintillation counter uses a canned NaI(Tl) crystal as a detector. Although the electronic components remain unchanged, a modification of the sample support was made to improve reproducibility of geometry. To assure comparable results between various counters, they must be operated at the same energy threshold and counting yield. Methods were developed to assure operation at a preferred energy

threshold of 0.1 Mev and an arbitrarily fixed counting yield of 3.36% for Cs^{137}–Ba^{137}. Partial pulse height discrimination against U^{237} is also accomplished. The proper interpretation of counting data is necessary if the best use is to be obtained with this instrument and if spurious results are to be avoided. Factors to relate data obtained on the GSC to the mica window beta counter (BGO), gamma spectrometer, and Shonka ion chamber were determined, which should aid in the interpretation of counting data. (auth)

4345 HW-31200
[Hanford Atomic Products Operation, Richland, Wash.]
AN IDEA FOR A WIDE RANGE NEUTRON FLUX MONITOR FOR HIGH FLUX REACTORS. J. T. Russell. Mar. 22, 1954. Decl. Jan. 13, 1956. 9p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

A fission chamber is mounted in a Cd-lined tube, which penetrates the reactor shield. The tube is filled with a liquid which has the function of scattering and absorbing neutrons. The Cd wall serves to screen the liquid from thermal neutrons which would otherwise enter the liquid from the reactor shield, and absorbs thermal neutrons scattered into it from the liquid thus reducing the diffusion of neutrons along the length of the wire. The fission chamber, which may be moved through the liquid will then have a counting rate which is a function of the position of the tube. (L.M.T.)

4346 LA-753
Los Alamos Scientific Lab., N. Mex.
PORTABLE FAST-NEUTRON FISSION-CHAMBER MONITOR. Richlard J. Watts. Oct. 13, 1949. Decl. Dec. 13, 1955. 13p. $3.30(ph OTS); $2.40(mf OTS).

An instrument that will detect fast neutrons by means of the fission of U^{238} is described. To attenuate the slow-neutron effect, the U is depleted of the 235 isotope to the ratio 5000/1. Battery-operated feedback amplifiers are used to obtain a pulse height sufficient to operate a discriminator and headphones. Circuit diagrams are given. (auth)

NEUTRONS

4347 CF-54-4-142
Oak Ridge National Lab., Tenn.
TEMPERATURE DEPENDENCE OF THE NEUTRON DIFFUSION COEFFICIENT IN HEAVY WATER. L. C. Noderer. Apr. 20, 1954. Decl. Dec. 20, 1955. 4p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The diffusion coefficient for neutrons having Maxwellian velocity distributions in heavy water were calculated for temperatures from 20°C to 320°C where first order chemical binding effects are accounted for. (C.H.)

4348 CP-644
[Chicago. Univ.] Metallurgical Lab.
THE EFFECT OF FAST FISSION ON k. H. Castle, H. Ibser, G. Sacher, and A. M. Weinberg. May 4, 1943. Decl. Dec. 12, 1955. 22p. (A-849). $4.80(ph OTS); $2.70 (mf OTS).

A general formula is derived for the contribution of fast neutron fission to the multiplication constant. Calculations are made for various geometries including spheres, cylinders, and slabs. Resultant values are given in graphical form. (B.J.H.)

4349 CP-1748
Chicago. Univ. Metallurgical Lab.
REPRESENTATION OF SLOWING DOWN FUNCTIONS IN WATER BY SYNTHETIC KERNELS. Albert Cahn, Jr. June 1, 1944. Decl. Jan. 4, 1956. 6p. Contract W-7401-eng-37. (A-2458). $1.80(ph OTS); $1.80(mf OTS).

Fermi, Anderson and Nagle's experimental distribution of Indium resonance neutrons around a point source of fission neutrons in water has been fitted by analytic expressions which are source functions in the two-group, three-group, Fermi and Christy-Wheeler pile theory. The Christy-Wheeler function (exponential followed by a Gaussian) is the best fit; the two-group function (exponential) is slightly better than the Fermi Gaussian. (auth)

4350 CP-2306
[Chicago. Univ. Metallurgical Lab.]
THE TEMPERATURE COEFFICIENT OF THE DIFFUSION LENGTH FOR THERMAL NEUTRONS IN WATER. V. C. Wilson, E. W. Bragdon, and H. Kanner. Oct. 28, 1944. Decl. Jan. 4, 1956. 13p. Contract W-7401-eng-37. $3.30 (ph OTS); $2.40(mf OTS).

The diffusion length of thermal neutrons in water as a function of the water temperature has been measured from 20 to 100°C. The results are expressed as a linear relation L = 2.644 + 0.0061T, where L is the diffusion length in centimeters and T is the temperature in degrees centigrade. (auth)

4351 CP-3453
Chicago. Univ. Metallurgical Lab.
AGE OF FISSION NEUTRONS IN D_2O. F. L. Friedman and A. Wattenberg. Mar. 6, 1946. Decl. Dec. 28, 1955. 11p. Contract W-7401-eng-37. $3.30(ph OTS); $2.40(mf OTS).

The spatial distribution of the neutrons slowed down in D_2O from a U^{235} fission source in In resonance has been measured. The data were fitted by combining a monokinetic diffusion and a Fermi slowing down, and the age from fission to 1.4 ev was determined to be 106 cm^2. (G.Y.)

4352 CP-3581
[Chicago. Univ.] Metallurgical Lab.
THE ACTIVATION OF THICK FOILS. J. Ernest Wilkins, Jr. June 27, 1946. Decl. Jan. 4, 1956. 16p. Contract W-7401-eng-37. $3.30(ph OTS); $2.40(mf OTS).

The fractional activation of a foil absorbing at resonance for the case in which the flux incident upon the foil has uniform angular distribution is calculated for a pure $1/v$ absorber. This absorber may be shielded from a thermal flux by means of a Cd shield or it may be exposed both to thermal and fast neutrons. Formulas for the fractional activation are derived in each case. (auth)

4353 LA-5
Los Alamos Scientific Lab., N. Mex.
INTEGRAL DIFFUSION PROBLEMS. S. P. Frankel and E. Nelson. Apr. 1943. Decl. Dec. 16, 1955. 13p. $3.30(ph OTS); $2.40(mf OTS).

The determination of the critical mass of a fissionable material and the rate of growth or decay of the neutron distribution in a noncritical amount of the material depends on the solution of an integral equation, in which it is assumed that all of the scattering is isotropic and that all cross sections are independent of velocity. The fact that the actual scattering is not isotropic can be taken into

account by introducing for the scattering cross section an appropriate average value. The nature of this averaging process is discussed. Similarly it is assumed that all neutrons have an appropriate mean velocity. Boundary conditions for approximate solutions and exact solution are discussed for bare and tamped spheres. (G.Y.)

4354 LA-276
Los Alamos Scientific Lab., N. Mex.
CAPTURE AND INELASTIC SCATTERING IN SPHERES OF VARIOUS METALS. A. O. Hanson, M. B. Fischer, S. L. Friedman, E. D. Klema, and J. H. Williams. May 12, 1945. Decl. Dec. 10, 1955. 19p. $3.30(ph OTS); $2.40(mf OTS).

The effective capture cross sections were determined for Y–Be, La–Be, and mock fission neutrons placed in the center of 10 cm spheres of U, W, Ta, Au, B, Fe, Cu, and Co. Data are tabulated. The values of the absorption cross sections are in general not the values corresponding to the initial energy of the neutrons, since the neutrons have been more or less degraded in passing through the spheres. The accuracy to which the long counters used have a flat response is indicated by experiments with degraded neutrons and Li (p,n) neutrons. Of the metals used, only U and W gave appreciable degradation due to inelastic scattering. Measuring techniques and instruments are described and interpretation of the observed transmissions is discussed. (C.H.)

4355 ORNL-641
Oak Ridge National Lab., Tenn.
THE RESONANCE INTEGRAL OF ZIRCONIUM (~ 1% HAFNIUM) AND THE SLOWING DOWN LENGTH IN A MIXTURE (4: 1 BY VOLUME) OF LIGHT WATER AND ZIRCONIUM METAL. J. I. Hoover and T. I. Arnette. July 27, 1950. Decl. Jan. 6, 1956. 19p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

Measurements have been made of the resonance integral for Zr (~1% Hf) and the slowing down distribution in Zr (~1% Hf)–light water mixture containing 20.4% Zr by volume. The resonance integral was measured in the energy range from Ra-α-Be neutrons to In resonance. The slowing down distribution was measured to In resonance using a fission source of neutrons. The value of the resonance integral is 23.9 cm^2, the major part of which is probably due to the Hf impurity. The mean square slowing down length $\overline{r}^2 = 213.97$ cm^2 and $\tau = 35.7$ cm^2. (auth)

NUCLEAR PHYSICS

4356 ANL-4097
Argonne National Lab., Lemont, Ill.
EXPERIMENTAL NUCLEAR PHYSICS DIVISION REPORT FOR OCTOBER, NOVEMBER, AND DECEMBER [1947]. Jan. 5, 1948. Decl. Jan. 17, 1956. 50p. Contract W-31-109-eng-38. $7.80(ph OTS); $3.30(mf OTS).

A discussion is given of progress in the following: lithium hydride as a pile shield moderator; flux measurement by weighing mercury from irradiated gold; scattering and transmission cross section measurements with annular ion chamber; resonance scattering survey; cobalt scattering cross section; the beta spectra of Au^{198} and W^{185}; the cross section of He^3; double transmission and depolarization of neutrons; the $B^{10}(n,p)Be^{10}$ reaction; total neutron cross sections of several compounds as a function of neutron energy; total slow neutron cross section of calcium-containing compounds and CaO; electronic development; triple isomerism in Sb; 47 hr. Sm; Hf; neutron diffraction in liquid elements; the photodisintegration of the deuteron; "cross-over transitions in nuclear disintegration schemes; short-lived halogen fission products; and bromine recoils from pile bombardment of ethyl bromide. (auth)

4357 ANL-4237
Argonne National Lab., Lemont, Ill.
EXPERIMENTAL NUCLEAR PHYSICS DIVISION REPORT FOR OCTOBER, NOVEMBER AND DECEMBER 1948. Jan. 7, 1949. Decl. Jan. 17, 1956. 67p. Contract W-31-109-eng-38. $10.80(ph OTS); $3.90(mf OTS).

4358 CP-2589
Clinton Labs., Oak Ridge, Tenn.
PHYSICS SECTION MONTHLY REPORT FOR THE PERIOD ENDING FEBRUARY 28, 1945. Mar. 2, 1945. Decl. Dec. 14, 1955. 59p. Contract W-7405-eng-39. $10.80(ph OTS); $3.90(mf OTS).

4359 KAPL-511
Knolls Atomic Power Lab., Schenectady, N. Y.
DEPENDENCE OF α OF U-233 ON TEMPERATURE. J. B. Sampson and H. Hurwitz, Jr. August 14, 1951. Decl. Dec. 6, 1955. 19p. Contract W-31-109-eng-52. $0.20(OTS).

Two lines of reasoning are used in considering the temperature dependence of α (ratio of radiative capture to fission) in U^{235} exposed to a thermal neutron flux. An experiment involving measurement of the ratio of fissions in U^{235} to capture in U^{238} with and without a Ag shell surrounding the U foil, is analyzed. The best value indicated from this experiment is $(d\alpha/dT) \sim -(10 \pm 5) \times 10^{-5}$/°C, in contrast to Wigner's result of -22×10^{-5}/°C by a similar analysis. Indications from neutron velocity selector results are that $d\alpha/dT$ is more apt to be positive than negative, and possibly as large as 10×10^{-5}/°C. There is no experiment which is definitely inconsistent with the assumption $d\alpha/dT = 0$, and moreover this zero value is a compromise between the qualitative values indicated by the two lines of reasoning considered. (auth)

NUCLEAR PROPERTIES

4360 CF-50-12-25
Oak Ridge National Lab., Tenn.
ESTIMATE OF EFFECTS OF HIGHER LEVELS ON THE RESONANCE INTEGRAL OF Xe^{135}. G. B. Arfken, Jr. and T. A. Welton. Dec. 6, 1950. Decl. Dec. 15, 1955. 6p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

4361 CP-1092
Chicago. Univ. Metallurgical Lab.
THE RESONANCE ABSORPTION SPECTRUM OF URANIUM. Sidney M. Dancoff. Nov. 24, 1943. Decl. Dec. 13, 1955. 15p. $3.30(ph OTS); $2.40(mf OTS).

A model for the capture spectrum of U is introduced in which levels occur at 7, 30, 30 + D, 30 + 2D, . . ., ev. Gamma ray and neutron widths are derived from the experimental data for values of D between 10 and 25 ev. The constants of the 7-volt level prove to be independent of D. Extrapolation, using the one level formula, gives a capture cross section at (1/40) ev of 4.9×10^{-24} cm^2; this number is, however, quite sensitive to the value taken for the resonance activation. Both neutron and gamma ray widths for the higher levels are approximately proportional to D. (auth)

4362 CP-1381
[Chicago. Univ.] Metallurgical Lab.
η TEMPERATURE EFFECT. E. W. Bragdon, D. Hughes, and John Marshall. Feb. 25, 1944. Decl. Dec. 13, 1955. 7p. (A-2022). $1.80(ph OTS); $1.80(mf OTS).

The temperature coefficient of η has been measured with the thermal column of the Argonne pile using U foils of different isotopic ratios. The temperature change was effected by filtering neutrons through Ag. The measured fractional change/°C is $-5.2 \times 10^{-5} \pm 1.1 \times 10^{-5}$. (auth)

4363 HW-27214
[Hanford Works, Richland, Wash.]
PRELIMINARY RESULTS OF THE RATIO OF PU^{239} FISSION CROSS SECTION TO U^{235} FISSION CROSS SECTION. B. R. Leonard, Jr. Decl. Jan. 7, 1956. 15p. Contract [W-31-109-eng-52]. $3.30(ph OTS); $2.40(mf OTS).

Plutonium and U foils were mounted in a back-to-back fission chamber, and the ratio of fission cross sections obtained were compared accurately at 0.10 ev neutron energy utilizing the Hanford crystal neutron spectrometer. A value of σ_f for Pu^{239} of 1.93 ± 0.1 at 0.01 ev was obtained. The ratio was obtained for the energy region 0.10 to 1.0 ev. (L.M.T.)

4364 ORNL-958
Oak Ridge National Lab., Tenn.
SURFACE TO MASS DEPENDENCE OF EFFECTIVE RESONANCE INTEGRALS FOR URANIUM 238 CYLINDERS J. R. Risser, G. B. Arfken, Jr., T. R. Cuykendall, R. J. Stephenson, and D. O. Caldwell. Mar. 20, 1951. Decl. Jan. 6, 1956. 25p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

The effective resonance integral for U^{238} has been determined as a function of the surface-to-mass ratio for cylinders of $\frac{5}{8}$- to 3-in. diam. The measurements were calibrated by comparison with the published value of the effective resonance integral with infinite shielding. A linear approximation (in which the mass term must be decreased by a volume disadvantage factor correction) has been determined. This correction to the mass term was found to be given accurately by the simple diffusion theory volume disadvantage factor. (T.W.S.)

4365 Y-691
Oak Ridge National Lab., Y-12 Area, Tenn.
TEMPERATURE DEPENDENCE OF XENON CROSS-SECTION. Gerald Goertzel and Alan B. Oppenheim. Nov. 29, 1950. Decl. Jan. 7, 1956. 5p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

Values of the Xe^{135} neutron cross section, averaged over a Maxwell distribution of neutron velocities, were obtained by numerical integration for various values of neutron temperature. (B.J.H.)

NUCLEAR REACTORS

4366 A-4315
[General Electric Co., Schenectady, N. Y.]
A MULTI-GROUP METHOD FOR COMPUTING CRITICAL MASSES OF INTERMEDIATE PILES. R. Erlich, H. Hurwitz, Jr., and J. R. Stehn. May 9, 1947. Decl. Dec. 16, 1955. 33p. (GE-RE-1). $6.30(ph OTS); $3.00(mf OTS).

4367 AECD-3882
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
A SPHERICAL, SINGLE SPACE VARIABLE, THREE-REGION, MULTIGROUP REACTOR CALCULATION ON IBM-701. (PROGRAM D.) E. D. Nix. Apr. 1, 1955. Decl. with deletions Dec. 13, 1955. 12p. $3.30(ph OTS); $2.40(mf OTS).

A machine method based on slowing down and diffusion for a 3-region homogeneous spherical core with a single outside reflector is demonstrated. Physical constants for each region and lethargy point are based on specific nuclear densities for elements in each region. Input data, convergence criteria, and output data are discussed. (K.S.)

4368 AECD-3921
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
FLUX DISTRIBUTIONS AND CRITICAL k_∞ VALUES FOR CYLINDRICAL REACTORS SIMULATING THE MTR. D. T. Bray and H. L. McMurry. June 25, 1952. Decl. with deletions Jan. 5, 1956. 27p. Contract [AT(10-1)-205]. $4.80(ph OTS); $2.70(mf OTS).

In order to estimate the effect of placing Bi and Th layers near the MTR core, radial flux distributions and k_∞ values were calculated for cylindrical reactors having cylindrical layers of these materials of the same height as the core and Be reflector and placed either next to the core or embedded in the Be reflector. The calculations assumed a vacuum above and below the effective height of the cylinders, the effective cylinder heights being equal to that of the MTR core plus the reflector savings due to the actual H_2O blanket above and below the MTR core. The cores of these reactors had the same composition as in the MTR and a cross sectional area equal to that of a 3 x 9 loading in the MTR. (auth)

4369 AECD-3942
Hanford Works, Richland, Wash.
ASPHALT AS A SHIELDING MEDIUM C-300. R. T. Jaske. Sept. 26, 1949. Decl. Dec. 20, 1955. 5p. Contract [W-31-109-eng-52]. (HDC-1440). $1.80(ph OTS); $1.80(mf OTS).

The use of asphalt as a fast neutron moderating substance is discussed. The high efficiency of asphalt as a neutron moderator is balanced by the added difficulties of shielding design. (C.W.H.)

4370 AECD-3948
California Research and Development Co., Livermore, Calif.
SELECTION OF ENGINEERING MATERIALS FOR LOW THERMAL NEUTRON ABSORPTION PROPERTIES. J. E. Mahlmeister, D. H. Inhoff, and J. P. Frankel. Sept. 13, 1951. Decl. Dec. 20, 1955. 16p. (CRD-T2B-40; LWS-24108). $3.30(ph OTS); $2.40(mf OTS).

A method is outlined for selecting materials including alloys for use as a structural member in a neutron flux based on its thermal neutron absorption properties. The optimum alloy is found to be one with the lowest (macroscopic absorption cross-section) — (thickness) product, where the thickness is found from the type of loading. The method applies to thin structural members and considers only one direction neutron impingement. This analysis evaluated the macroscopic cross-section for the alloy by weighting the individual element cross sections for thermal neutrons by their percentage volume in the alloy. Tables of macroscopic cross sections are given for stainless steels, Al alloys, Invar, Armco iron, and Al bronze. (G.Y.)

4371 AECD-3985
Oak Ridge National Lab., Tenn.
SOME ASPECTS OF REACTOR THEORY. Alvin M. Weinberg. Oct. 10, 1952. Decl. with deletions Jan. 4, 1956.

26p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Some general remarks are made on reactor theory, particularly the asymptotic theory and multigroup methods. Unsolved reactor problems are also briefly discussed. (B.J.H.)

4372 AECD-4016

[Los Alamos Scientific Lab., N. Mex.]

RECALCULATION OF CRITICAL MASSES OF U AND Pu WATER TAMPED SOLUTIONS. E. Greuling. Sept. 1, 1949. Decl. Jan. 13, 1956. 10p. (T-169). $3.30(ph OTS); $2.40(mf OTS).

A method of computing the critical mass of U^{235} contained in a water solution confined to a spherical core and surrounded by an infinite water tamper is described. A modification of the method is described to take into account the effect of the resonance fission and absorption present in water solutions of Pu. The physical constants required are discussed. (auth)

4373 AECD-4018

Oak Ridge National Lab., [Y-12 Area], Tenn.

NOTE ON THE NON-LINEAR KINETICS OF CIRCULATING-FUEL REACTORS. S. Tamor. Aug. 15, 1952. Decl. Jan. 13, 1956. 12p. Contract W-7405-eng-26. (Y-F10-109). $3.30(ph OTS); $2.40(mf OTS).

Assumptions are made that the instantaneous power density is constant along the length of the fuel tubes, that the excess reactivity depends only upon the average fuel temperature, and that the fuel temperature at the inlet is kept constant. The effect of delayed neutrons is ignored. It is proved, for the non-linear case, that its negative temperature coefficient makes this reactor inherently stable even without damping provided by delayed neutrons. (G.Y.)

4374 AECD-4069

Knolls Atomic Power Lab., Schenectady, N. Y.

PILE CONTROL IV. Nuclear Engineering Course 1947–1948. F. E. Crever. May 13, 1948. Decl. with deletions Jan. 10, 1956. 19p. $3.30(ph OTS); $2.40(mf OTS).

The use and effectiveness of absorbing material, reflector variation, moderator removal, and fuel removal as reactor control devices are discussed. (D.E.B.)

4375 CF-47-4-115

Oak Ridge National Lab., Tenn.

ACTIVITIES IN PROCESS WATER. W. S. Farmer. Apr. 7, 1947. Decl. Dec. 20, 1955. 33p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

The recycling of the process water though the active region of the reactor produces radioactivity in the process water. The source of this radioactivity is (1) activation of dissolved salts in the water, (2) activation of the water itself, (3) activation of the corrosion products, (4) corrosion of active metal and (5) metal recoils from the surface of the reactor. The activity of the water stream in the proposed flash vaporization process water cooling system is of the order of 2×10^9 mev/cc seconds of gamma radiation and 4.1×10^6 mev/cc second of beta radiation as the water leaves the active reactor. This activity undergoes a reduction of 100 fold in the first 100 seconds of time elapsing after it leaves the reactor. This rapid decrease in activity is due to the decay of the 8-sec. nitrogen resulting from an (n,p) reaction on the oxygen of the water. From 100-sec. time elapse until the water reenters the reactor the decay is much more gradual. The above radiation intensity results in a dose of gamma radiation of 370 r/8 hr day at the surface of a 36-in. pipe immediately upon leaving the reactor. The beta emission is stopped by the pipe wall. The dose 100 seconds, later, at which time the water is entering the flash cooler at the surface of a 36-in. pipe is in the region of 1 r/8 hr day. Assuming that 2 ppm of sodium dichromate and 20 ppm of sodium silicate are added to the water to prevent corrosion, the activity discharge to the river is 7.5 dis/cc second or 0.20 microcurie/liter. One-fifteenth of this activity is due to long lived chromium from the dichromate while the remainder is Na^{24} from several sources. This is well within the present tolerance level for sodium of 0.5 microcurie/liter. In order to reduce the radiation level to less than 0.01 r/8 hr day, it is necessary to shield the equipment as shown. The activity discharged to the river amounts to 0.468 microcurie/liter. This allows a safety factor of 2 for mixing in the retention basin and assumes the use of 2 ppm of sodium dichromate and 20 ppm of sodium silicate for corrosion inhibition. The plastic coatings should last several hundred years before receiving a total tolerance of 10^7 r units. (auth)

4376 CF-49-1-65

Oak Ridge National Lab., Tenn.

SUPPLEMENTARY REPORT TO THE DESIGN OF SHIM-SAFETY ROD. D. Nicoll. Dec. 31, 1948. Decl. Dec. 19, 1955. 29p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

The design of shim-safety control rods to cover recent design changes in the rod drive mechanism is discussed. These changes, necessitated by space limitations on the top plug and the desire to make the packing glands accessible, involve moving the drive motors from the top plug surface to the underside of the platform and redesign of the packing gland. The present design of the shim-safety rod is shown. A catalogue for the shim-safety rod is attached, which lists the layouts and detail drawings necessary for fabrication of the rod and associated equipment. (auth)

4377 CF-50-1 125

Oak Ridge National Lab., Tenn.

THERMAL SHIELD FOR THE MATERIALS TESTING REACTOR. William E. Sholl, Jr. Jan. 25, 1950. Decl. Dec. 15, 1955. 27p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

The design proposal and data for the thermal shield and the neutron absorbing curtain of the Materials Testing Reactor are presented. Data from the critical experiment will doubtless make for refinement of the detailed design; however, no major revisions to the design proposal presented are expected. (C.H.)

4378 CF-50-3-102

Oak Ridge National Lab., Tenn.

COOLING OF THE GRAPHITE REFLECTOR FOR THE MATERIALS TESTING REACTOR. R. B. Briggs. Mar. 20, 1950. Decl. Dec. 20, 1955. 57p. Contract [W-7405-eng-26]. $9.30(ph OTS); $3.60(mf OTS).

Heat production curves and calculations involved in specifying the cooling of the graphite reflector for the Materials Testing Reactor are reported. The maximum design temperatures for the graphite are 570°F in the pebble bed and 500°F in the permanent graphite. Because the heat production rates obtained by extrapolation of experimental data are so much greater than calculated rates, the specifications are based upon operation at a pile power

of 45,000 kw. It is certain that the maximum design temperatures will not be exceeded when operating at 30,000 kw and it is probable that they will not be exceeded when operating at 60,000 kw. The total heat removed from the graphite is estimated to be 750 kw. The specified total air flow and pressure loss are 28.3 lb/sec and 29 inches of water. (auth)

4379 CF-50-4-3
Oak Ridge National Lab., Tenn.
NEUTRON SPECTRUM EMERGING FROM A WATER SHIELD. S. Podgor. Apr. 3, 1950. Decl. Dec. 21, 1955. 9p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

An equation is obtained for the neutron spectrum, emerging from a water shield of any thickness. For a thickness of 62 cm the spectrum shows a maximum intensity at ~6.5 Mev. (auth)

4380 CF-50-6-25
Oak Ridge National Lab., Tenn.
THICKNESS OF DOOR UNDER BOTTOM PLUG. N. F. Lansing. June 2, 1950. Decl. Jan. 5, 1956. 5p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Supporting calculations for design of the door over the bottom plug of the Low Intensity Training Reactor (LITR) are presented. (B.J.H.)

4381 CF-50-7-125
Oak Ridge National Lab., Tenn.
EFFECT OF THE CONDUCTION OF HEAT FROM THE GRAPHITE REFLECTOR UPON THE TEMPERATURES IN THE EAST SIDE THERMAL SHIELD OF THE MATERIALS TESTING REACTOR. R. B. Briggs. July 24, 1950. Decl. Jan. 5, 1956. 13p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Temperatures in the thermal shield adjacent to the graphite were calculated, taking into consideration the flow of heat from the reflector. Results indicate maximum and minimum temperatures of ~245 and 35°F, respectively. Corresponding temperature differences through the thicknesses of the plate are 14 and 2°F. (L.M.T.)

4382 CF-50-8-49
[Oak Ridge National Lab., Tenn.]
SHIELDING OF NUCLEAR REACTORS. LECTURE III. GEOMETRY TRANSFORMATIONS FOR SHIELDING. E. P. Blizard. Aug. 14, 1950. Decl. Dec. 15, 1955. 9p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

4383 CF-50-8-116
Oak Ridge National Lab., Tenn.
RESONANCE ABSORPTION BY Xe. Alvin M. Weinberg. Aug. 29, 1950. Decl. Dec. 15, 1955. 3p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A mathematical analysis is made of neutron resonance absorption by Xe. (B.J.H)

4384 CF-50-11-41
Oak Ridge National Lab., Tenn.
CRITICAL CALCULATIONS FOR HOMOGENEOUS LOW ENRICHMENT $UO_2SO_4-D_2O$ SYSTEMS. L. C. Noderer and N. F. Lansing. Nov. 13, 1950. Decl. Dec. 15, 1955. 25p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70 (mf OTS).

4385 CF-51-4-110
Oak Ridge National Lab., Tenn.
GAMMA RAY MEASUREMENTS AT THE BULK SHIELDING FACILITY, EXPERIMENT I, 100% WATER. L. H. Ballweg. Apr. 27, 1951. Decl. Dec. 15, 1955. 6p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Centerline measurements were made of the γ radiation of the Bulk Shielding Facility in 100% H_2O at 100 watts and 10 kilowatts. The resultant data are summarized in both tabular and graphical form. (B.J.H.)

4386 CF-51-4-156
Oak Ridge National Lab., Tenn.
CENTERLINE FOIL MEASUREMENTS OF THERMAL NEUTRON INTENSITIES FOR EXPERIMENT 1. E. B. Johnson, G. McCammon, and M. P. Haydon. Apr. 18, 1951. Decl. Dec. 15, 1955. 8p. [Contract W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The attenuation of thermal neutrons from the Bulk Shielding Facility was measured in H_2O along the north-south centerline by means of In foils. The resultant data are summarized. (B.J.H.)

4387 CF-51-5-61
Oak Ridge National Lab., Tenn.
FAST NEUTRON DOSIMETER MEASUREMENTS FOR EXPERIMENT 1 IN THE BULK SHIELDING FACILITY. R. G. Cochran and H. E. Hungerford. May 7, 1951. Decl. Dec. 21, 1955. Contract [W-7405-eng-26]. 7p. $1.80(ph OTS); $1.80(mf OTS).

Fast neutron dosage measurements were taken in water to nearly 170 cm. with the Bulk Shielding Facility dosimeter. Complete results are tabulated and compared to the Lid Tank dosimeter measurements. (B.J.H.)

4388 CF-51-5-62
Oak Ridge National Lab., Tenn.
THERMAL NEUTRON MEASUREMENTS FOR EXPERIMENT 1 IN THE BULK SHIELDING FACILITY. H. E. Hungerford, Jr. May 4, 1951. Decl. Dec. 21, 1955. 14p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Experiment 1 consisted in measurement of the radiation from the reactor in pure water along the centerline. The flux measurements are tabulated and compared with Lid Tank data. (G.Y.)

4389 CF-51-5-72
Oak Ridge National Lab., Tenn.
THERMAL NEUTRON MEASUREMENTS FOR EXPERIMENT 2 AT THE BULK SHIELDING FACILITY. H. E. Hungerford and E. B. Johnson. May 11, 1951. Decl. Dec. 21, 1955. 10p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Measurements were made of thermal neutrons along the centerline of the Bulk Shielding Facility behind an Fe shield approximately 17 in. thick. The data are tabulated and compared graphically with the previously obtained neutron attenuation in H_2O. (B.J.H.)

4390 CF-51-5-73
Oak Ridge National Lab., Tenn.
FAST NEUTRON DOSIMETER MEASUREMENTS FOR EXPERIMENT 2. R. G. Cochran and H. E. Hungerford. May 11, 1951. Decl. Dec. 21, 1955. 5p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Measurements of fast neutron dosage were made behind a 17-in. Fe shield at the Bulk Shielding Facility. The results are tabulated and compared graphically with those obtained previously with a 100% H_2O shield. (B.J.H.)

4391 CF-51-6-9
Oak Ridge National Lab., Tenn.
THERMAL STRESS IN THE HRE REFLECTOR TANK. I. Spiewak. June 5, 1951. Decl. Dec. 22, 1955. 22p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

The thermal stresses induced in the reflector tank and cover flange of the HRE have been evaluated. They are shown to be safe for normal operating conditions, and to permit overloads up to 6400 kw, in reactor power. The procedure followed in the calculations is presented in detail. It may be applied to similar thermal stress problems. (auth)

4392 CF-51-8-151
Oak Ridge National Lab., Tenn.
EBR SLUG DISSOLVING. Quarterly Report for May Through July 1951. E. M. Sampson, Jr. Aug. 17, 1951. Decl. Dec. 21, 1955. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Procedures for the dissolution of both Al-jacketed and bare slugs from the EBR are summarized. (B.J.H.)

4393 CF-51-11-59
Oak Ridge National Lab., Tenn.
DESIGN DATA FOR HRE CHARCOAL ADSORBERS. I. Spiewak. Nov. 9, 1951. Decl. Dec. 16, 1955. 4p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Arbitrary specifications for the HRE charcoal adsorbers are listed. An evaluation is made of the performance of the bed on the basis of previously published data. The temperature of the bed is also analyzed. (B.J.H.)

4394 CF-51-11-149
Oak Ridge National Lab., Tenn.
EXPERIMENTAL PHYSICS PROGRAM FOR THE HRE. Sidney Visner. Nov. 28, 1951. Decl. Dec. 15, 1955. 36p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

The experimental physics program of the Homogeneous Reactor Experiment is outlined. Included are procedures for proposed criticality experiments, reactivity control calibrations, and reactivity coefficient measurements. (B.J.H.)

4395 CF-52-1-62
Oak Ridge National Lab., Tenn.
OVERALL STABILITY OF THE HRE. T. A. Welton. Jan. 5, 1952. Decl. Jan. 5, 1956. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Calculations are presented for use in determining the stability of the complete Homogeneous Reactor Experiment system. Nuclear, thermal, and mechanical components are considered in a simplified calculation. Assumptions used are outlined and the equations presented. (C.H.)

4396 CF-52-1-160
Oak Ridge National Lab., Tenn.
PRELIMINARY RESULTS OF AN EXPERIMENT TO DETERMINE THE LOSS OF REACTIVITY IN THE LITR DUE TO THE BUILD-UP OF POISON. T. E. Cole. Jan. 30, 1952. Decl. Jan. 4, 1956. 11p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

An experimental check on the predicted effect of Xe^{135} poisoning in the MTR was made by observing the effect in the MTR mockup and comparing this with the calculated effect. (C.H.)

4397 CF-52-2-37
Oak Ridge National Lab., Tenn.
BULK SHIELDING FACILITY WATER DATA WORK SHEET. H. E. Hungerford. Feb. 1, 1952. Decl. Dec. 21, 1955. 2p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

A worksheet of the BSF centerline attenuation data of nuclear radiations in H_2O shows the data plotted both in terms of flux and dose. For convenience, the D unit is used as the dose unit for both gamma radiation and fast neutrons, and conversion factors given. (L.M.T.)

4398 CF-52-6-165
Oak Ridge National Lab., Tenn.
PHENOMENOLOGICAL THEORY OF THE ATTENUATION OF NEUTRONS BY AIR DUCTS IN SHIELDS. A. Simon and C. E. Clifford. June 25, 1952. 16p. Decl. Jan. 4, 1956. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40 (mf OTS).

Experiments on the attenuation of neutrons by air ducts in water can be understood on a simple phenomenological picture. First, the attenuation of neutrons in a long thin straight section is shown to be a function of $(1/l)^2$, where l is the length of the duct. These neutrons are primarily the uncollided neutrons which have traveled directly in air from one end of the duct to the other. Next, the attenuation due to a duct which consists of two straight sections joined at an angle θ is considered. Finally, the formula is extended to the case of any number of straight sections joined at arbitrary angles. (auth)

4399 CF-52-7-126
Oak Ridge National Lab., Tenn.
MTR, RELATIVE VOLUMES OF ALUMINUM, WATER, BERYLLIUM AND AIR IN CORE AND REFLECTOR. W. R. Gall. July 24, 1952. Decl. Dec. 15, 1955. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A detailed study of MTR drawings has been made to determine the Al to H_2O ratio in the core and the volumes of H_2O, Al, Be and air in the reflector. Effects of certain changes on the Al to H_2O ratio in the core were calculated. (auth)

4400 CF-52-8-31
Oak Ridge National Lab., Tenn.
DESIGN DATA FOR ISHR (FIRST EDITION). R. B. Briggs. Aug. 4, 1952. Decl. Dec. 16, 1955. 9p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The first design data sheets for the main ISHR circulating system are given. These data are applicable to two 5,000 gpm loops or one 10,000 gpm loop. (D.E.B.)

4401 CF-53-5-211
Oak Ridge National Lab., Tenn.
HRP DYNAMIC CORROSION STUDIES—SUMMARY OF RUN N-15. J. C. Griess and R. E. Wacker. May 29, 1953. Decl. Dec. 20, 1955. 3p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Scale adhering to the interior surface of a loop was removed with a mixture of HCl, H_2SO_4, and H_2O_2. Solution analysis showed a relatively high concentration of U, Ni, Fe, Cr, and Mn, and indicated a corrosion rate of 1.8 in. per year. (D.E.B.)

4402 CF-53-7-221
Oak Ridge National Lab., Tenn.
PRELIMINARY BOILING EXPERIMENTS IN THE SUPO MODEL OF THE WATER BOILER. D. G. Thomas. July 23, 1953. Decl. Dec. 20, 1955. 19p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

It has been demonstrated that it is possible to operate a homogeneous reactor under boiling conditions and that under the particular conditions encountered, a boiling homogeneous reactor is not inherently unstable. The solution density change on going from non-boiling to boiling conditions has been calculated using the two-group two-region method. The maximum density change found was

0.8% corresponding to a total nuclear power of 5.4 kw. For small reactivity additions the relationship $\Delta k/k = 0.3 \Delta d/d$ is good to ± 10%. Average bubble rise rates of 10 ft/sec were calculated assuming that 1 kw of heat was dissipated in uniform volume boiling. This suggests that the onset of vapor evolution in the solution increased the rate of circulation and thereby the rate of surface evaporation. Disengagement velocities from the free surface of the water boiler were found to be 30 to 50 lbs. of vapor/(hr) (sq ft). (auth)

4403 CF-54-4-203
Oak Ridge National Lab., Tenn.
PHYSICAL PROPERTIES OF HIGH CONCENTRATION HRT BLANKET SOLUTIONS OF UO_2SO_4-D_2O FROM THE MOUND LABORATORY REPORTS. C. L. Segaser. Apr. 29, 1954. Decl. Dec. 22, 1955. 16p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Data are summarized on the physical properties of $UO_2SO_4-D_2O$ systems. Applications of these data to engineering studies on the core and blanket systems and performance of heat exchangers in circulating fuel homogeneous types of power-breeder reactors are discussed. (C.H.)

4404 CF-54-5-188
Oak Ridge National Lab., Tenn.
DESIGN BASIS FOR VOLUME OF PRESSURIZER IN HRT. Paul R. Kasten. May 24, 1954. Decl. Jan. 5, 1956. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Since the effect of an increase in the pressurizer pressure is to lower the rate at which fluid is ejected from the reactor core during a power surge, a correspondence exists between maximum core pressure and pressurizer volume. The resulting core pressure in the HRT core as a function of instantaneous reactivity addition is plotted, using pressurizer volume and length of piping as parameter. (D.E.B.)

4405 CF-54-6-165
Oak Ridge National Lab., Tenn.
CENTERLINE MEASUREMENTS ON A 5 × 6 FUEL ELEMENT ARRANGEMENT OF A WATER-REFLECTED REACTOR AT THE BULK SHIELDING FACILITY. H. E. Hungerford and G. M. Estabrook. June 21, 1954. Decl. Dec. 19, 1955. 10p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Fast neutron, thermal neutron, and γ ray flux measurements at the BSF are tabulated. (D.E.B.)

4406 CF-54-7-158
Oak Ridge National Lab., Tenn.
HEATING AND THERMAL STRESS IN HRT PRESSURE VESSEL DURING A SHUTDOWN. P. M. Wood. July 27, 1954. Decl. Jan. 4, 1956. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Calculations are presented on the temperature rise and thermal stress in the Homogeneous Reactor Test pressure vessel when the reactor is dumped. During the few minutes required to empty the core and blanket high pressure systems, part of the pressure vessel may be exposed to direct radiation from the core. There is no significant cooling of this part of the vessel. Calculations were made for two limiting situations. One assumes that the reactor continues to operate at 5 Mw core power as the blanket level is lowered. The other assumes the chain reaction immediately decays to a low level leaving only the fission product decay γ as a radiation source. (C.H.)

4407 CF-54-9-114
Oak Ridge National Lab., Tenn.
SUMMARY OF THERMAL BREEDER CALCULATIONS. M. C. Edlund. Sept. 20, 1954. Decl. Jan. 4, 1956. 6p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Calculations are presented which were used in revised estimates of the breeding ratio in two-region-homogeneous U^{233}–Th blanket breeders. Revised figures for neutron leakage were used. Results are compared with results from multi-group calculations made using the Eyewash program on the Univac and with preliminary results of calculations made at Brookhaven. (C.H.)

4408 CNL-36
Clinton National Lab., Oak Ridge, Tenn.
THEORETICAL CALCULATIONS OF CRITICAL MASSES FOR CERTAIN P-9 PILES. H. L. Garabedian. Mar. 3, 1948. Decl. Dec. 28, 1955. 42p. Contract W-35-058-eng-71. $7.80(ph OTS); $3.30(mf OTS).

Included are experimental data and fundamental constants for various D_2O reactors, including the inhomogeneous case, calculations of critical radii for spherical reactors with finite reflectors by both the conventional and variational two-group methods, discussions of the variational method with Gaussian and Gaussian-Yukawa kernels for the sphere with infinite reflector, graphs of reflector savings for the spherical case, and two-group and Gaussian-Yukawa calculations for various cylindrical reactors. (B.J.H.)

4409 CP-445
[Chicago. Univ. Metallurgical Lab.]
LOW-DENSITY UO_2 PILE. H. W. Ibser. Feb. 24, 1943. Decl. Dec. 15, 1955. 6p. Contract [W-7401-eng-37]. $1.80(ph OTS); $1.80(mf OTS).

The multiplication factor and minimum pile size for a multiplying pile using UO_2 powder of density 1 have been computed. It appears that a k of 1.0177 is possible for a volume ratio of $V_0/V_{UO_2} = 3.33$. (auth)

4410 CP-1069
[Chicago. Univ.] Metallurgical Lab.
SOME CASES OF PILE ACTIVITY FLATTENING. N. Morehouse and G. Young. Nov. 10, 1943. Decl. Dec. 14, 1955. 11p. Contract [W-7401-eng-37]. (A-1460). $3.30(ph OTS); $2.40(mf OTS).

Radial flattening of activity in the cores of spherical and cylindrical piles is discussed in connection with pile control and power improvement. Partial flattening as a result of k loss from temperature rise is also considered. (auth)

4411 CP-1361
[Chicago. Univ. Metallurgical Lab.]
RECALCULATION OF THE CRITICAL SIZE AND MULTIPLICATION CONSTANT OF A HOMOGENEOUS UO_2-D_2O MIXTURES. E. P. Wigner, A. M. Weinberg, and J. Stephenson. Feb. 11, 1944. Decl. Dec. 13, 1955. 7p. (A-2006). $1.80(ph OTS); $1.80(mf OTS).

The multiplication constant and optimal concentration of a slurry pile is recalculated on the basis of Mitchell's experiments on resonance absorption. The smallest chain reacting unit contains 45 to 55 m^3 of D_2O. (auth)

4412 CP-1814
[Chicago. Univ.] Metallurgical Lab.
JACKET TEMPERATURE NEAR END OF SLUG. G.

Young. June 23, 1944. Decl. Dec. 15, 1955. 7p. Contract [W-7401-eng-37]. (A-2640). $1.80(ph OTS); $1.80(mf OTS).

Some situations which give rise to a hot ring around the slug near the end are considered; namely rounded slug ends in the long cartridge design, and the Wilkins effect in the current unbonded short slug design. (auth)

4413 CP-1989
[Chicago. Univ. Metallurgical Lab.]
THE DISTRIBUTION OF THERMAL NEUTRONS IN A SLUG WITH THICK END CAPS. J. Ernest Wilkins, Jr. Aug. 3, 1944. Decl. Dec. 12, 1955. 11p. (A-3005). $3.30(ph OTS); $2.40(mf OTS).

The distribution of thermal neutrons in a slug having a 1-cm Al end cap was calculated on the basis of simple diffusion theory. It is found that the average neutron density, and therefore the power output, at the end of the slug is about 34% higher than the density far from the end cap. This result agrees well with the other Argonne pile experiments. (auth)

4414 CP-2071
[Chicago. Univ. Metallurgical Lab.]
FURTHER END CAP TEMPERATURE CALCULATIONS. W. Karush, A. T. Monk, and J. E. Wilkins, Jr. Aug. 16, 1944. Decl. Dec. 15, 1955. 6p. (A-3013). $1.80(ph OTS); $1.80(mf OTS).

It has been shown that the neutron density, and thus the heat production, at the end of a slug with an Al cap may be appreciably higher than that at the middle of the slug. A re-examination of earlier temperature calculations is made in light of this effect. (auth)

4415 CP-2701
[Chicago. Univ. Metallurgical Lab.]
PILE HEAT EXCHANGER CALCULATIONS. Gale Young. Feb. 14, 1945. Decl. Dec. 19, 1955. 10p. Contract W-7401-eng-37. $3.30(ph OTS); $2.40(mf OTS).

Some idealized calculations relating to the design of heat exchangers for minimum holdup of pile coolant are presented in compact form to facilitate quick estimates. Their use is illustrated by application to a falling film-type exchanger. (auth)

4416 CP-3068
[Chicago. Univ. Metallurgical Lab.]
A NOTE ON THE KINETICS OF HOMOGENEOUS PILES. J. Ernest Wilkins, Jr. June 26, 1945. Decl. Dec. 15, 1955. 7p. Contract W-7401-eng-37. $1.80(ph OTS); $1.80 (mf OTS).

Previous analyses of the effect of bubble production on pile reactivity have assumed that the production of bubbles follows the production of power instantaneously. The implications of the introduction of an intermediate dissolved gas stage under two hypotheses on the formation of bubbles from this dissolved gas are investigated. It is seen that this additional stage tends to make the pile unstable. (auth)

4417 CP-3435
[Chicago. Univ. Metallurgical Lab.]
EFFECT OF ROUTING UPON TEMPERATURE OF COOLING STREAM. Albert S. Cahn, Jr. Feb. 14, 1946. Decl. Dec. 19, 1955. 14p. Contract W-7401-eng-37. $3.30 (ph OTS); $2.40(mf OTS).

The ratio of the temperature of the hottest spot in a reactor to the average exit temperature of the coolant is calculated for several idealized flow patterns. Pressure drop differences, reflector effects, and effect of film drop on heat transfer are considered. (G.Y.)

4418 CT-910
Chicago. Univ. Metallurgical Lab.
STEAM BUBBLE SIZE AND RATE OF RISE THROUGH WATER AT ITS NORMAL BOILING POINT. J. T. Weills. Sept. 3, 1943. Decl. Dec. 12, 1955. 5p. $1.80(ph OTS); $1.80(mf OTS).

Evaporation of the moderator inside a homogeneous slurry pile and condensation of the vapor in external heat exchangers has been considered for removing heat from the system. An apparatus was erected and preliminary data were collected on the bubble size and rate of rise of steam bubbles through water at its boiling point in an attempt to evaluate the effect of vapor bubbles on bulk density and on heat removal from a boiling liquid. This experimentation was cancelled since other investigations indicated that the effect of density in power piles is too critical to permit bubble formation. (auth)

4419 CT-3460
[Chicago. Univ. Metallurgical Lab.]
ESTIMATES REGARDING GAS FLOW AND HEAT TRANSFER IN A HIGH TEMPERATURE OXIDE FILE. A. F. Robertson, L. W. Fromm, and H. E. Kittredge. Mar. 1, 1946. Decl. Dec. 20, 1955. 29p. Contract W-7401-eng-37. $4.80(ph OTS); $2.70(mf OTS).

Final design of the proposed BeO moderated pile, for operation at high temperatures to produce useful power, requires a choice of the optimal interrelated values of a number of values concerning pressure drops and heat transfer characteristics. To clarify the problems involved, estimates have been made of pressure drops for six different shapes of fuel rods the effect of variation in alignment of the rods on the pressure drop; the fraction of pile power required for circulating the coolant gas; the effect of diameter of a hole in the fuel rods on gas flow distribution, total pile voids, and temperature distribution in gas streams and in the solid; the effect of assumed variation in heat production rates across the pile on the temperature difference between the fuel rods and coolant gas; the effect of the emissivity of BeO on the temperature difference between the fuel rods and the coolant gas; and the effect of pile power on temperature variation between coolant gas streams and walls of fuel tubes. (auth)

4420 HW-24455
[Hanford Works, Richland, Wash.]
VISIT TO PUGET SOUND NAVAL SHIPYARD FOR DRILLING URANIUM SLUGS. Trip report. S. S. Jones. May 6, 1952. Decl. Jan. 5, 1956. 8p. Contract [W-31-109-eng-52]. $1.80(ph OTS); $1.80(mf OTS).

Attempts were made to machine U slugs in order to provide for the introduction of a thermocouple assembly to measure the various effects of reactor operation on slug central temperature. (B.J.H.)

4421 HW-24639
Hanford Works, Richland, Wash.
REMOTELY OPERATED IRRADIATION FACILITY (SAMPLE CARRIER). J. C. Fox. June 2, 1952. Decl. Dec. 8, 1955. 11p. $3.30(ph OTS); $2.40(mf OTS).

This remotely operated facility for handling samples eliminates awkward handling procedures and permits charging and discharging during operation. A discussion of

operating requirements for such equipment and a possible general arrangement are presented. (L.M.T.)

4422 HW-25107
Hanford Works, Richland, Wash.
DESIGN CONSIDERATIONS FOR A LATTICE TEST PILE. W. A. Horning. July 28, 1952. Decl. Jan. 5, 1956. 12p. Contract [W-31-109-eng-52]. $3.30(ph OTS); $2.40(mf OTS).

A lattice test pile design is proposed as a substitute for more costly exponential piles. The test pile would yield buckling and pile constant data more rapidly than existing exponential installations. A method is presented for simplifying the complexities introduced by edge effects. (K.S.)

4423 HW-29110
Hanford Works, Richland, Wash.
LATTICE CELL CALCULATIONS I—DETERMINATION OF $\mathcal{K}$ FOR A URANIUM SLUG. G. W. Stuart, Jr. Aug. 24, 1953. Decl. Jan. 6, 1956. 8p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

A first iteration of the diffusion theory result is executed for the thermal flux distribution in a $7\frac{1}{2}$-in. graphite-U lattice cell using the integral equation formulation of transport theory. A modification of the Serber-Wilson method then allows one to extract the inverse diffusion length $\mathcal{K}$ of the slug. Applications of this method are discussed. (auth)

4424 HW-31482
Hanford Atomic Products Operations, Richland, Wash.
ON THE SELF-DEPRESSION OF THERMAL FLUX CAUSED BY A SMALL FOIL. G. W. Stuart. Apr. 16, 1954. Decl. Jan. 6, 1956. 5p. Contract [W-31-109-eng-52]. $1.80(ph OTS); $1.80(mf OTS).

The use of small foils for neutron flux measurements requires correction for the flux perturbation caused by introduction of the foil. The effect of foil location on flux perturbation has been investigated by comparing the flux depression due to a foil in an infinite homogeneous medium of nuclear properties, I, to that due to a foil located at the plane interface between 2 semi-infinite regions of nuclear properties I and II. Equations have been derived and calculations performed for the specific case of a gold foil, assuming region I to be graphite and region II to be uranium. It was found for the case calculated that the flux depressions relative to the unperturbed flux were equal within 0.2% of the unperturbed flux. (L.M.T.)

4425 HW-32535
Hanford Atomic Products Operation, Richland, Wash.
THE EFFECT OF EPI-CADMIUM FISSION OF 25 IN THERMAL REACTORS. George W. Stuart, Jr. July 23, 1954. Decl. Jan. 7, 1956. 2p. Contract [W-31-109-eng-52]. $1.80(ph OTS); $1.80(mf OTS).

Experimental evidence has revealed that a Cd-covered U slug processes 8% of the multiplication constant assigned to the same slug without coating. This effect is due to U^{235} fissions in the intermediate energy range. Modified forms for the expressions for multiplication constant, conversion ratio, and two-group critical relation are presented. (M.P.G.)

4426 HW-32669
Hanford Atomic Products Operation, Richland, Wash.
THE EFFECT OF EPI-CADMIUM FISSION OF 25 IN THERMAL REACTORS—II. G. W. Stuart, Jr. and H. Neumann. Aug. 5, 1954. Decl. Jan. 7, 1956. 5p. Contract [W-31-109-eng-52]. $1.80(ph OTS); $1.80(mf OTS).

A numerical evaluation of the effect of epi-cadmium fission of U^{235} in reactors is presented. Assuming the experimental value of $n = 0.08$, an effective value of $1 + \alpha = 1.31$ was obtained for U^{235} in the resonance range. (M.P.G.)

4427 IDO-16008
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
FUEL ASSEMBLY HEAT EVOLUTION IN TRANSFER COFFIN. D. T. Bray and W. L. Morris. Mar. 31, 1952. Decl. Jan. 7, 1956. 11p. $1.80(ph OTS); $1.80(mf OTS).

For certain research purposes it is desirable to move a hot MTR fuel assembly to the CPP for processing as soon as possible. The fuel assemblies give off considerable heat in the form of β and soft γ rays and the thermal behavior of fuel assembly and container must be considered. The container proposed for the fuel assemblies consists of a lead coffin inside which is a stainless steel cylinder filled with water in which the fuel assembly is to be placed. Results are presented of the calculations for the time it will take for the water to reach boiling due to the heat liberated by the MTR fuel assembly cooled one day after 30% burnup in 30 days. Both the case in which there is water between lead and stainless steel, and the case in which there is air in that space is considered. (auth)

4428 IDO-16062
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
MTR THERMAL NEUTRON FLUXES. Carl F. Leyse. Feb. 27, 1952. Decl. Jan. 6, 1956. 7p. $1.80(ph OTS); $1.80(mf OTS).

Five figures are presented showing thermal neutron flux distributions in the MTR. All curves are for a 9 × 3 north slab loading of the reactor core. Results from critical experiments and the mockup were used wherever possible. The methods of extrapolation and calculation used in preparing each of the figures are summarized. (L.M.T.)

4429 IDO-16085
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
THEORETICAL ANALYSIS OF THE NEUTRON FLUX MEASUREMENTS IN THE MTR CANAL. Lee H. Boyer. Apr. 15, 1953. Decl. Jan. 6, 1956. 16p. Contract AT(10-1)-205. $3.30(ph OTS); $2.40(mf OTS).

Experiments have shown that there is a neutron flux in the order of 10^4 n/cm^2-sec near spent fuel elements stored in the MTR canal 20 days after reactor shutdown. By a comparison of experimental data with theoretical calculations, it is shown that the measured neutron flux can be attributed to the (γ-n) reaction of a 2.5 Mev gamma from La^{140} upon the deuterium in the water. It appears that the neutron-foil-activation technique could be developed into a satisfactory method for the measurement of the burn-up of spent fuel elements. (auth)

4430 IDO-16092
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
THERMAL STRESS IN MTR BERYLLIUM REFLECTOR AT INCREASED POWER LEVELS. C. F. Leyse. Apr. 1, 1953. Decl. Jan. 6, 1956. 9p. Contract AT(10-1)-205. $1.80(ph OTS); $1.80(mf OTS).

The thermal stresses at several points in the Be reflector were calculated These preliminary calculations show that for operation of the reactor above 60 mw it will

be necessary to use Be L-pieces and Cd–Be shim rods of a different design. The portion of the reflector lying outside the reactor lattice will probably be satisfactory for operation at power levels as high as 150 mw, provided thermal stresses are the limiting factor. Further investigation is recommended before increasing the reactor power any substantial amount. (auth)

4431 IDO-16104
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
GAMMA ATTENUATION IN BEAM HOLES. C. F. Leyse. May 14, 1953. Decl. Jan. 6, 1956. 5p. Contract AT(10-1)-205. $1.80(ph OTS); $1.80(mf OTS).

The beam-hole plugs in the MTR holes, HB3 and HB6, were retracted to various positions and the heat removed by the plug-cooling water was used to estimate the attenuation of the γ flux down the open holes. The results of the measurements are given. The attenuations are experimental and are essentially the same in both HB3 on the north side and HB6 on the south side of the reactor core. (auth)

4432 IDO-16112
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
MTR TWO-WEEK OPERATING CYCLES FUEL REQUIREMENT AND LOADING ARRANGEMENT FOR INITIAL OPERATIONS. G. H. Hanson, L. H. Boyer, and J. W. Webster. Aug. 31, 1953. Decl. Jan. 5, 1956. 48p. Contract AT(10-1)-205. $7.80(ph OTS); $3.30(mf OTS).

A modified policy has been proposed which involves a scheduled two-week operating cycle with a 13-day operating period followed by a 24-hr shutdown. The fuel charge will be a combination of new and used elements. The calculations associated with the development of the fuel requirement and loading arrangement for initial operations are presented. (auth)

4433 IDO-16144
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
EVALUATION OF ACTIVE LATTICE GEOMETRIES AND CYCLE TIMES FOR THE MTR. C. F. Leyse. Oct. 5, 1953. Decl. Jan. 5, 1956. 19p. Contract AT(10-1)-205. $3.30(ph OTS); $2.40(mf OTS).

An evaluation of various active lattice loadings shows that the present 3 × 9 core has a higher yearly fuel cost than several other geometries, and also does not provide as many high neutron flux experimental positions. The 5 × 6 core is probably the optimum loading since it has the lowest yearly fuel cost of the various geometries considered and provides a choice group of experimental positions with high neutron fluxes. With a 5 × 6 core the three-week cycle is preferred over the two-week cycle since the former is more economical when shutdown costs are included in the comparison. (auth)

4434 KAPL-33
Knolls Atomic Power Lab., Schenectady, N. Y.
NUCLEAR ENGINEERING COURSE 1947–1948. HEAT TRANSFER I. R. C. Martinelli. Jan. 29, 1948. Decl. Jan. 9, 1956. 21p. $4.80(ph OTS); $2.70(mf OTS).

Heat generation and heat transfer in nuclear reactors are discussed. Coolant criteria are outlined, and heat transfer limitations on pile output and various methods for solving conduction problems are discussed. (C.H.)

4435 KAPL-50
Knolls Atomic Power Lab., Schenectady, N. Y.
PILE NEUTRON PHYSICS VIII. Nuclear Engineering Course 1947–1948. R. Ehrlich. Mar. 4, 1948. Decl. Jan. 10, 1956. 25p. $4.80(ph OTS); $2.70(mf OTS).

The multigroup method for estimating critical sizes of various assemblies is discussed. The principle of the electrical simulator for solving other than spherical assemblies is mentioned. (G.Y.)

4436 KAPL-70
[Knolls Atomic Power Lab., Schenectady, N. Y.]
PILE CONTROL III. Nuclear Engineering Course, 1947–1948. H. E. Stevens, Jr. May 6, 1949. Decl. Jan. 11, 1956. 21p. Contract [W-31-109-eng-52]. $4.80(ph OTS); $2.70(mf OTS).

Control and poison problems for thermal reactors are discussed. Curves on Xe^{135} formation, neutron absorption, and decay are presented and discussed in detail. (C.H.)

4437 KAPL-82
Knolls Atomic Power Lab., Schenectady, N. Y.
PILE CONTROL V. Nuclear Engineering Course, 1947–1948. T. M. Snyder. May 20, 1948. Contract [W-31-109-eng-52]. Decl. Jan. 11, 1956. 10p. $1.80(ph OTS); $1.80(mf OTS).

A brief, introductory lecture on instrumentation aspects of start-up, operation, and failure is presented in a very general manner. (G.Y.)

4438 KAPL-494
Knolls Atomic Power Lab., Schenectady, N. Y.
CONSTANT REACTIVITY CONDITIONS FOR THE CONTINUAL OPERATION AND U^{235} START-UP OF AN INTERNAL PLUTONIUM BREEDER. T. M. Snyder. Mar. 12, 1951. Decl. Jan. 3, 1956. 8p. Contract W-31-109-eng-52. $1.80(ph OTS); $1.80(mf OTS).

The feasibility of designing a breeder such that its reactivity is independent of burnup (provided that the fuel is mixed with the proper quantity of fertile material) is considered to first and second approximations. A study of the feasibility of startup with U^{235} indicates that there will be a minimal control problem in making a transition from U^{235} to Pu fuel. (C.H.)

4439 LA-206
Los Alamos Scientific Lab., N. Mex.
A SIMPLIFIED METHOD FOR CALCULATING CRITICAL SIZES. H. A. Bethe. Jan. 19, 1945. Decl. Dec. 15, 1955. 6p. Contract [W-7405-eng-36]. Charge $1.80(ph OTS); $1.80(mf OTS).

A very simple method for calculating critical masses and multiplication rates in the case of one neutron velocity, based on assuming a simple exponential distribution of neutrons in the tamper, is analyzed. It can be reduced to the condition that a certain quantity referring to the tamper alone is equal to a corresponding quantity referring to the core alone. (G.Y.)

4440 M-4461
[Brookhaven National Lab., Upton, N. Y.]
REPORT ON THE HELIUM SYSTEM EXPERIMENT AT OAK RIDGE, TENNESSEE. H. W. Newson. [nd]. Decl. Jan. 7, 1956. 3p. Contract [AT-30-2-gen-16]. $1.80 (ph OTS); $1.80(mf OTS).

The design of the helium system for the Brookhaven Reactor depends on the amount of radioactive contamination in the He gas. As a basis for calculations of radio-

activity, a series of experiments were performed at the Clinton Pile. A slug canned at Brookhaven had an 80-ft-long and one-eight-in.-diameter Al tube attached to it. The system was filled with He and placed in the middle of the Clinton Pile for approximately two weeks. Measurements were made on the radioactivity of He removed from the tube after various periods of irradiation. The He was evacuated through a charcoal trap and replaced several times during the experiment. (C.H.)

4441 MonP-412
[Clinton Labs., Oak Ridge, Tenn.]
INTERIM NOTE ON MIXED PILE STUDIES. J. R. Menke. Sept. 25, 1947. Decl. Jan. 6, 1956. 13p. Contract W-35-058-eng-71. (CLM-JRM-3). $3.30(ph OTS); $2.40(mf OTS).

Results are presented from a preliminary survey of mixed piles. Calculations are reported using two-group diffusion theory for a series of piles with different macroscopic geometries but with identical microscopic properties. Such characteristics as critical size, percent of fast fissions, and hot spots were investigated. Data on variable microscopic properties are included in an appendix. (C.H.)

4442 MonP-413
[Clinton Labs., Oak Ridge, Tenn.]
ARRANGEMENT OF COOLING SPACES FOR LEAST THERMAL STRESS. G. Young. Oct. 22, 1947. Decl. Jan. 5, 1956. 10p. Contract W-35-058-eng-71. $1.80 (ph OTS); $1.80(mf OTS).

The arrangement of cooling spaces in the Be reflector of the LITR is discussed. A "hole-in-block" arrangement gives less thermal stress for small volumes of coolant than a plate arrangement. In some instances, a "split-plate" arrangement might compare favorably but has warping troubles. (auth)

4443 MonP-423
[Clinton Labs., Oak Ridge, Tenn.]
AN ESTIMATE OF THE PROTOACTINIUM LOSS IN A THERMAL PILE. G. Goertzel. Oct. 30, 1947. Decl. Jan. 6, 1956. 5p. Contract W-35-058-eng-71. $1.80 (ph OTS); $1.80(mf OTS).

Calculations are outlined for estimating the loss of breeding efficiency in thorium breeder reactors due to neutron capture by Pa^{233}. (C.W.H.)

4444 ORNL-73
Oak Ridge National Lab., Tenn.
ANALYSIS OF THERMAL STRESSES IN BERYLLIUM ASSEMBLIES FOR THE HIGH FLUX REACTOR. Final Report—Problem Assignment No. TX13-5. W. B. Allred and H. C. Savage. July 27, 1948. Decl. Jan. 6, 1956. 11p. Contract W-7405-eng-26. Charge $1.80 (ph OTS); $1.80(mf OTS).

An experimental investigation of the stability of the beryllium reflector assemblies to thermal stresses expected in the high flux pile, (LITR) is discussed. Assemblies were subjected to thermal stresses which would result from heat fluxes 4.5 times greater than anticipated in the reactor during operation. Fifty cycles of alternate heating to 4.5 times the maximum expected reactor level and sudden cooling produced no cracking or failure. It is concluded that the beryllium reflector assemblies are adequately stable to thermal stresses which would result from heat fluxes 4.5 times greater than will occur in the high flux reactor as presently designed. On this basis, it is believed that the cooling requirements per assembly may be safely reduced by at least one half. (auth)

4445 ORNL-120
Oak Ridge National Lab., Tenn.
HEAT DISSIPATION FROM FUEL ASSEMBLIES OF HIGH FLUX REACTOR AFTER SHUTDOWN. W. K. Stromquist. Aug. 1948. Decl. Jan. 6, 1956. 30p. Contract W-7405-eng-26. Charge $4.80(ph OTS); $2.70(mf OTS).

Experiments conducted with a mock fuel assembly channel show that natural convection of residual cooling water in the high flux reactor (LITR) furnishes adequate cooling capacity after shutdown following 20 days operation at 30,000-kw power level. Heat transfer by natural convection of air is not sufficient to prevent melting of fuel assemblies after shutdown following such operation. Theoretical investigations cited are consistent with the experimental data. (auth)

4446 ORNL-120(Suppl. 1)
Oak Ridge National Lab., Tenn.
HEAT DISSIPATION FROM FUEL ASSEMBLIES OF LOW POWER–HIGH FLUX REACTOR AFTER SHUT DOWN. W. K. Stromquist. Nov. 1948. Decl. Jan. 6, 1956. 29p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

Experiments using a mock fuel assembly channel 11.4 mm thick, approximately the size channel considered for the low power-high flux reactor (LITR), show that between 1270 and 1470 Btu/(sq ft) (hr) can be transferred by natural convection of air without exceeding the melting point of aluminum in the channel. Calculations show that an operating power level of about 1000-kw is permitted by this heat transfer capacity. (auth)

4447 ORNL-203
Oak Ridge National Lab., Tenn.
EFFECT OF WATER SOAKING ON SHIELDING PROPERTIES OF THE OAK RIDGE PILE SHIELD. S. W. W. Shor and J. M. Cassidy. Jan. 12, 1949. Decl. Jan. 6, 1956. 32p. Contract W-7405-eng-26. $6.30(ph OTS); $3.00(mf OTS).

This experiment was originally designed to measure the intensity of neutron and gamma ray fluxes through the Oak Ridge pile shield in its present state. However, water used as a seal against streaming of neutrons soaked into the concrete of the shield. This resulted in a reduction of the effective neutron relaxation length by about 20%. Inasmuch as there was already a large quantity of oxygen in the shielding material, the effect can probably be ascribed to an increase by a factor of 1.8 in hydrogen content. The relaxation length for gamma rays was found to be 13.9 centimeters, although the gamma rays produced in the shield by neutron scattering and capture cannot be distinguished from the primary gamma rays from the pile. A number of auxiliary results are given, including information on size of experimental holes required to obtain data which are essentially those of the surrounding shielding material rather than of material in the hole, and a discussion of the use of aluminum foils to detect neutrons above about 4.6 Mev. (auth)

4448 ORNL-241
Oak Ridge National Lab., Tenn.
PHYSICAL TESTS ON CORE DRILLINGS FROM THE ORNL GRAPHITE REACTOR SHIELD. Period of test: Mar. 15 to Nov. 15, 1948. Theodore Rockwell, III. Feb.

28, 1949. Decl. Jan. 6, 1956. 30p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

At the request of the Operations Division, three cores approximately four inches in diameter were cut with diamond core drills completely through the west face of the concrete shield of the ORNL Graphite Reactor. These cores were tested for compressive strength, density, water content, chemical composition, and residual induced radioactivity, all as a function of position in the shield. Temperatures were also taken at various positions along the core plug, with the reactor operating and shut down, and radiation intensity through the shield is also shown from data by the Operations Division and experiments by the shielding group. It is concluded that the radiation has apparently had very little effect on the concrete, the special haydite-barytes concrete has three-to five-fold higher water content than normal concrete, but somewhat less than the 10% specified, the specific gravity of both the special and the normal concrete is quite low, ~2.2, the strength of the special concrete is well up to specifications, ~2500 psi, the strength of the normal concrete is quite low, ~1800 psi, the asphalt layer enclosing the special shield appears to be intact, but appraently did not prevent loss of water at the inside face. (auth)

4449 ORNL-255
Oak Ridge National Lab., Tenn.
CAM-TYPE PLATE-SPACING GAGE FOR THE MATERIALS TESTING REACTOR FUEL ASSEMBLIES. J. A. Kyger, F. Kerze, and W. H. Wilson. July 5, 1949. Decl. Jan. 6, 1956. 11p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

A cam-type gage has been developed for measuring the internal spacing between the active plates of the Materials Testing Reactor fuel assemblies. Measurements are made rapidly and are of adequate accuracy. Conventional gaging methods were found inadequate due to the narrow, deep spaces involved. (auth)

4450 ORNL-357
Oak Ridge National Lab., Tenn.
MONITORING THE OAK RIDGE PILE BY AIR VELOCITY MEASUREMENT. Oscar Sisman and W. H. Brand. July 13, 1949. Decl. Jan. 5, 1956. 22p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

Two methods have been developed for continuously monitoring the Oak Ridge pile by air velocity measurements in order to detect slug failures through the resulting constriction in the air channel, before they plug the channel completely or discharge radioactive dust into the atmosphere. These methods are velocity pressure from a pitot transmitted through a strain-gage type of differential pressure gage to an electronic recorder, and the potential of an electrically heated thermopile in the air stream transmitted to an electronic recorder. Either type of element can be mounted at the ends of the shield plugs in the charging face of the pile. While the pitot-strain gage system has practically instantaneous response, the lag in the thermocouple system is only a few minutes. This is far less time than is required for the slug to rupture or to block the channel. The estimated costs of installation are respectively $100,000.00 and $50,000.00. It is recommended that the thermocouple system be installed in the Oak Ridge pile, if a continuous monitoring system is required. (auth)

4451 ORNL-428
Oak Ridge National Lab., Tenn.
CANADIAN MEASUREMENTS OF AN IRON–WATER SHIELD. E. P. Blizard. Jan. 3, 1950. Decl. Dec. 2, 1955. 12p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

Measurements were made on the Fe–H_2O laminated shield underneath the NRX Reactor. The neutron attenuation of the shield is shown. The first 30 in. of the Fe–H_2O shield shows a fairly constant relaxation length of about 5.0 cm, which compares favorably with that of other Fe–H shields. (B.J.H.)

4452 ORNL-438
Oak Ridge National Lab., Tenn.
ATTENUATION MEASUREMENTS IN HEAVY AGGREGATE M-1 CONCRETE. H. P. Sleeper, Jr. and C. E. Clifford. Sept. 26, 1949. Decl. Jan. 6, 1956. 14p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

Neutron and γ attenuation measurements in heavy aggregate M-1 concrete were made in the core hole in the west face of the shield of the ORNL Graphite Reactor. The attenuation data are given in graphical form. Results indicate that both M-O and M-1 concretes have nearly equal shield performance in terms of relaxation length for neutrons and relaxation weight for γ rays. (B.J.H.)

4453 ORNL-472
Oak Ridge National Lab., Tenn.
MTR STRAIN MEASUREMENTS. H. C. Savage. Nov. 22, 1949. Decl. Jan. 6, 1956. 21p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

The magnitude of stresses in various parts of the Heterogeneous Pile (MTR) Mock-Up under operating conditions were determined. Baldwin-Southwark "SR-4" resistance wire strain gages were used in making all strain measurements from which values of stress were calculated. All stresses were found to be well under the allowable yield strength of the materials involved. A maximum stress of 1875 psi existed in the aluminum tank Section D when the maximum water flow rate of 14,500 GPM was used. At this flow rate the pressure in Tank A was 41 psi and 13 psi in Tank E. (auth)

4454 ORNL-525
Oak Ridge National Lab., Tenn.
THE NEUTRON FLUX SPECTRUM AND FAST AND EPITHERMAL FLUX IN HOLE 19 OF THE ORNL REACTOR. C. D. Bopp and O. Sisman. July 28, 1950. Decl. Jan. 6, 1956. 30p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

The fast neutron flux spectrum was determined for hole 19 of the ORNL Graphite Reactor by the use of threshold detectors. The reactions employed were $Al^{27}(n,\alpha)Na^{24}$, $Mg^{24}(n,p)Na^{24}$, $Al^{27}(n,p)Mg^{27}$, $S^{32}(n,p)P^{32}$ and $P^{31}(n,p)Si^{31}$. The flux above 1 Mev was calculated to be 0.12×10^5 neutrons/(cm^2) (sec) (watt). The epicadmium flux up to 1 Mev, calculated from Cd difference measurements, was determined to be 1.8×10^5 neutrons/(cm^2) (sec) (watt). (auth)

4455 TID-5049
Brookhaven National Lab., Upton, N. Y.
INITIAL EXPERIMENTS ON THE BROOKHAVEN REACTOR. II. THE SUBCRITICAL PILE WITH NATURAL SOURCES. J. Chernick. Mar. 10, 1949. Decl. Jan. 6, 1956. 13p. $3.30(ph OTS); $2.40(mf OTS).

Result of investigations on the theory of the subcritical

pile are summarized. The formulas derived were used for analysis of loading experiments on the BNL Reactor, determination of spontaneous neutron yield of U^{238}, the fitting of flux distributions, the correction of the effective radius of the pile for the presence of a reflector, etc. (L.M.T.)

4456 TID-5052
Brookhaven National Lab., Upton, N. Y.
INITIAL EXPERIMENTS ON THE BROOKHAVEN REACTOR. V. FAST SOURCE CORRECTION FOR SIGMA PILES. R. S. Margulies. May 13, 1949. Decl. Jan. 6, 1956. 4p. $1.80(ph OTS); $1.80(mf OTS).

Using the data of Seren, corrections are found for the sigma pile work done at Brookhaven using a Ra–Be source. This correction amounted to 1.23 cm. Using similar data obtained at Brookhaven, the correction for a Po–Be source is found to be 0.59 cm. These corrections are to be subtracted from experimental data. The correction of 0.6 cm checks with the value stated by J. Chernick in the fourth paper of this series. The latter value was obtained by the use of age theory for an infinite pile. These values are based on experimental data for a parallelopiped pile. (auth)

Refer also to abstract 4472.

NUCLEAR TRANSFORMATION

4457 LA-1078
Los Alamos Scientific Lab., N. Mex.
THE FISSION NEUTRON SPECTRUM OF PLUTONIUM. Julia Carlson, Norris Nereson, and Shirley Suttman. Mar. 8, 1950. Decl. Jan. 5, 1956. 21p. Contract W-7405-eng-36. $4.80(ph OTS); $2.70(mf OTS).

The fission-neutron spectrum of Pu^{239} as produced by thermal neutrons, has been measured from 0.4 to 7 Mev, using nuclear emulsion techniques. (G.Y.)

PARTICLE ACCELERATORS

4458 AECD-3815
Tennessee Eastman Corp., Oak Ridge, Tenn.
CLEANING E-UNITS BY BLASTING. (Experiment Performed December 14 to December 20, 1944.) Jack R. McWherter and Stephen Yerazunis. Sept. 8, 1945. Decl. Nov. 28, 1955. 11p. Contract [W-7401-eng-23]. (D-4.340.1). $3.30(ph OTS); $2.40(mf OTS).

An air–water–abrasive blasting system was found to thoroughly clean copper parts of E units without damage to the parts. Little abrasive is required because of the continuous recycle of the abrasive slurry. (J.E.D.)

4459 CF-51-5-182
Oak Ridge National Lab., Tenn.
STATUS REPORT ON THE 63" CYCLOTRON HEAVY PARTICLE ACCELERATOR. A. Zucker, J. L. Fowler, and R. S. Livingston. May 25, 1951. Decl. Dec. 21, 1955. 7p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80 (mf OTS).

4460 UCRL-1830(Rev.)
California. Univ., Berkeley. Radiation Lab.
MTA TARGET EQUATIONS. H. P. Kramer and F. Adelman. May 22, 1952. Decl. Dec. 3, 1955. 12p. Contract [W-7405-eng-48]. $3.30(ph OTS); $2.40(mf OTS).

RADIATION ABSORPTION AND SCATTERING

4461 M-4204
Oak Ridge National Lab., Tenn.
GAMMA RAY ATTENUATION TESTS ON STEEL PLATES AND 1" DIAMETER STEEL PUNCHINGS. N. J. Palladine and C. E. Clifford, Jr. Oct. 31, 1947. Decl. Dec. 6, 1955. 7p. (CF-47-11-33). $1.80(ph OTS); $1.80(mf OTS).

A summary is presented of data obtained from γ-ray attenuation tests on steel plates and 1 in.-diameter and 0.5-in.-thick steel punchings. The tests were run at the shielding hole of the Clinton Pile. (C.H.)

Refer also to abstract 4354.

RADIATION EFFECTS

4462 AECD-3796
North American Aviation, Inc., Downey, Calif.
THE POSSIBILITY OF "FREEZING-IN" RADIATION DAMAGE EFFECTS IN SIMPLE METALS. E. P. Cooper and M. M. Mills. June 20, 1950. Decl. with Deletions Dec. 5, 1955. 12p. Contract AT-11-1-GEN-8. $0.15(OTS).

The desirability of observing radiation damage effects in simple metals has led to the suggestion that damage could be "frozen-in" by conducting experiments at low temperature. Vand's data has been utilized to estimate the necessary low temperature for a number of metals, with the result that exposures at solid CO_2 temperatures will probably be adequate in many cases and experiments conducted at liquid air temperatures will almost certainly be successful. This conclusion is supported by experimental data for copper, for which damage effects have been retained at ~110°K. (auth)

4463 CC-2319
Chicago. Univ. Metallurgical Lab.
THE EFFECTS OF NEUTRON BOMBARDMENT ON THE ELECTRICAL RESISTANCE OF ALUMINUM, BERYLLIUM AND TUBALLOY [URANIUM]. I. Problem Assignment No. 323 MLC 2302. J. Royal. Nov. 2, 1944. Decl. Jan. 4, 1956. 10p. $1.80(ph OTS); $1.80(mf OTS).

Wigner effects on Al, Be, and U, have been studied by the electrical resistance method. Samples were exposed during an interval which would have produced an increase of ~22% in resistance of AGOT-K graphite. The resistance of U increased ~1%. It is shown that the increase can be accounted for by the amount of fission product impurity formed during the exposure. Neither Al nor Be showed any change. In the case of Be, the Wigner effect may be obscured, to some extent, by the ~0.2 to 0.3 atom % of impurity present in the samples. Based on the increase occurring in AGOT-K graphite, a change of ~0.2 to 0.5×10^{-6} ohm-cm might be expected in the case of Be. The accuracy of the method was sufficiently great to detect a change of this magnitude. Other experiments with Be will be undertaken when purer samples are available. Meanwhile, some samples of the present type are being subjected to further irradiation. (auth)

RADIOACTIVITY

4464 CC-1631
Clinton Labs., Oak Ridge, Tenn.
CONTRIBUTIONS TO THE WATER PROBLEM. T. B.

Novey. June 10, 1944. Decl. Dec. 13, 1955. 10p. Contract [W-7405-eng-39]. (A-2482). $1.80(ph OTS); $1.80(mf OTS).

An investigation of the short-lived activities produced in oxygen compounds by irradiation with pile neutrons was undertaken to aid in the study of the activities expected in the cooling water from the W pile. The chemical identification of the 8 second activity found in pile irradiated O compounds and a preliminary study of the recoil range of Al^{28} from $Al^{27}(n,\gamma)$ reaction are reported. (J.E.D.)

SHIELDING

4465 CF-53-2-99
Oak Ridge National Lab., Tenn.
HEATING BY FAST NEUTRONS IN A BARYTES CONCRETE SHIELD. F. H. Abernathy and H. L. F. Enlund. Feb. 11, 1953. Decl. Dec. 19, 1955. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The moderation of fast neutrons in shield materials results in the loss of their energy which then appears as heat. This prediction of the rate of heat generation is based on the concepts of a non-varying fast neutron removal cross section in the region of interest and a Fermi age slowing down density. (auth)

4466 ORNL-32
[Oak Ridge National Lab., Tenn.]
SHIELDING EFFICIENCY OF AN OXYCHLORIDE–IRON CONCRETE—COMPARISON WITH HANFORD SHIELD. E. P. Blizard, C. E. Clifford, and J. Cassidy. May 21, 1948. Decl. Jan. 6, 1956. 45p. Contract W-35-058-eng-71. Charge $7.80(ph OTS); $3.30(mf OTS).

Radiation attenuation tests were made on both a Hanford shield sample and an iron aggregate oxychloride cement. The measurements consisted of the detection of neutrons throughout the shield by means of gold foils and the detection of γ radiation through increasing thicknesses of shield by means of a collimated G-M tube with a fixed geometry. These samples were exposed to a pile flux of approximately 10^{10} n/cm^2/sec and an accompanying γ flux which extrapolated to about 12,000 r/hr at the inner face of the shield. Various arrangements of thermal shields were tested with both samples in an effort to determine qualitatively the effect on the production and transmission of γ rays with a variation of the capture medium in the first or thermal portion of shield sample. The results indicate that the gammas are reduced in number when boron is used in the front portion of shield, with or without an iron thermal shield. The neutron attenuation in the outer portions of the shield is essentially unaffected by the nature of the outer portions of the shield is essentially unaffected by the nature of the thermal shield. The MO and Hanford samples displayed approximately equal over-all neutron attenuation. Gamma intensities were less through out the MO sample than at corresponding points in the Hanford sample. (auth)

4467 ORNL-33
Oak Ridge National Lab., Tenn.
TEST OF RADIATION ATTENUATION THROUGH CONCRETE SHIELD CONTAINING A HELICAL DUCT. C. E. Clifford and N. J. Palladino. May 1, 1948. Decl. Jan. 5, 1956. 32p. Contract AT-33-1-GEN-53. $6.30(ph OTS); $3.00(mf OTS).

Tests included transverse neutron intensity measurements across the specially constructed test blocks containing the helix as well as longitudinal neutron surveys along the helix. Survey of the helix was made with uncovered and cadmium covered BF_3 counters. Gamma-ray intensity measurements were made along the helix as well as external to the helix. Results indicate a continuously varying neutron attenuation along the helix, so that no single relaxation length can be assigned to the shield. The cadmium ratios also varied considerably along the helix. A specially constructed 100 R chamber indicated a gamma-ray relaxation length of 14.8 cm. Data is also presented on the characteristics of an experimental methane counter for measurement of fast neutrons. The results of these tests indicate that the helical duct of the dimensions tested has possibilities for use in conducting coolants from the pile without unduly reducing the effectiveness of the shield. (auth)

SPECTROSCOPY

4468 A-4735
Carbide and Carbon Chemicals Corp., Oak Ridge, Tenn.
THE AUTOMATIC MASS SCANNER. Raymond C. Smith. Mar. 25, 1946. Decl. Dec. 27, 1955. 33p. Contract [W-7405-eng-26]. $7.80(ph OTS); $3.30(mf OTS).

The Mass Spectrum Scanner is designed to permit scanning of the complete Mass Spectrum of any line recorder from mass 12 to mass 400. The scanning operation, after connections are made, requires about eleven minutes. The scanner consists of four panels; a large condenser, a high voltage supply for charging the condenser, a recorder, and a main control panel. The condenser, after being charged, is discharged through a high resistance in the main control panel. Relays in the main control panel apply the potential across this resistance to the line recorder mass spectrometer tube in lieu of the potential from the high voltage supply of the line recorder. The recorder in the scanner is substituted for the line recorder micromax. The recorder is a Brown continuous balance potentiometer type of instrument which draws a continuous line determined by the output of the amplifier in the line recorder. (auth)

URANIUM AND URANIUM COMPOUNDS

4469 ANL-4775
Argonne National Lab., Lemont, Ill.
STATISTICAL DISTRIBUTION OF URANIUM WARP MEASUREMENTS. Parker D. Deans. Oct. 8, 1951. Decl. Dec. 2, 1955. 14p. Contract W-31-109-Eng-38. $3.30(ph OTS); $2.40(mf OTS).

Studies of the distribution of uranium warp measurements are summarized, and certain applications permitted by a knowledge of the parameters are presented. It should not be inferred that the results presented draw any conclusions concerning the effect of variables other than random variables on uranium warp. In addition, it is not known whether the same statistical distribution holds for uranium slugs which differ dimensionally from those studied (i.e., $\frac{3}{4} \times 8$ in. and 1×8 in.). In general, distributions of variable measurements can be characterized by three parameters: (1) the arithmetic mean (average) or measure of central tendency; (2) the standard deviation or measure of spread; and (3) the skewness or

measure of the asymmetry of the distribution. For the well known Gaussian or "normal" distribution the skewness is zero indicating that this distribution is symmetrical about the arithmetic mean. A parameter which may be substituted for the standard deviation is the coefficient of variation which is the standard deviation expressed as a percentage of the arithmetic mean. The coefficient of variation is particularly useful where the standard deviation is a function of the arithmetic mean. The studies reported show the coefficient of variation and the skewness to be constants over the range of average warps evaluated (i.e., 1.5 mils to 12.3 mils warp). The values determined for these parameters are: for the coefficient of variation, 54.2% with 95% limits of uncertainty of 51.8 to 56.9%; and for the skewness factor, 0.94 with 95% limits of uncertainty of 0.90 to 0.98. A coefficient of variation of 54.2% means that the spread of the distribution as measured by the standard deviation is 54.2% of the arithmetic mean or average. The skewness factor of 0.94 indicates that the distribution "tails off" in the direction of warps which are greater than average, and that the degree of this "tailing off" is independent of the magnitude of the average warp. (auth)

4470 CF-1627
Clinton Labs., Oak Ridge, Tenn.
NEUTRON MULTIPLICATION IN A MASS OF URANIUM METAL. Final Report—Problem Assignment 307-X10P "Snell" Experiment. J. E. Brolley, F. J. Byerley, B. Feld, A. E. Olds, R. Schalettar, L. Slotin, and R. B. Stewart. Apr. 1, 1944. Decl. Dec. 12, 1955. 43p. (A-2489). $7.80 (ph OTS); $3.30(mf OTS).

Measurements were made of neutron multiplication in 35 tons of U metal, using the Clinton pile as a neutron source, a three-group approximation was used to derive the neutron distribution in the metal. Detailed descriptions of the experimental set-up and measurements are also given. (B.J.H.)

4471 CP-400
[Chicago. Univ. Metallurgical Lab.]
CHAIN REACTION OF PURE FISSIONABLE MATERIALS IN SOLUTION. Robert F. Christy and John A. Wheeler. Jan. 1, 1943. Decl. Dec. 15, 1955. 16p. Contract [W-7401-eng-37]. (A-451). $3.30(ph OTS); $2.40(mf OTS).

The critical mass of Pu^{239} and the corresponding critical dimensions of homogeneous mixtures of Pu^{239} with various moderating media have been calculated as a function of the concentration of Pu. A simple transformation makes the figures applicable to U^{235}. The problem of the stability of a chain reaction in solution and questions of protection are discussed. (auth)

4472 CP-668
[Chicago. Univ.] Metallurgical Lab.
ON THE MULTIPLICATION CONSTANT OF HOMOGENEOUS MIXTURES OF U WITH VARIOUS MODERATORS. E. P. Wigner and J. Stephenson. May 15, 1943. Decl. Dec. 12, 1955. 11p. (A-872). $3.30(ph OTS); $2.40(mf OTS).

Calculations on the multiplication constant of homogeneous mixtures of U and different moderators are summarized. The moderators considered were D_2O, heavy paraffin, He, C, H_2O, Be, and H. The radius of the critical sphere for a mixture of U and heavy paraffin is also shown. (B.J.H.)

4473 CT-2959
Ames Lab., Ames, Iowa.
NOTE ON ATTEMPTS TO PREPARE MAGNESIUM AND CALCIUM ALLOYS OF URANIUM. D. H. Ahmann. Dec. 5, 1945. Decl. Dec. 16, 1955. 4p. Contract W-7405-eng-82. $1.80(ph OTS); $1.80(mf OTS).

Attempts to prepare Mg–U alloys by reduction of UF_4 with a large excess of Mg or by holding U in molten Mg did not reveal any certain reaction between the metals. Annealing U–Mg mixtures at 1200°C for 24 to 48 hr in sealed graphite-lined crucibles indicated a possible interaction at the interface, but this was not confirmed by x-ray diffraction. No reaction between Ca and U could be observed on annealing mixtures at 800°C for 24 hr. (G.Y.)

4474 ORNL-53
Oak Ridge National Lab., Tenn.
ABSORPTION OF RADIATION FROM AN "X" [NATURAL U] SLUG BY LEAD. Final Report—Problem Assignment No. TX13-5. G. Ascoli and O. Sisman. May 1948. Decl. Jan. 6, 1956. 16p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

The decay of an X (natural U) slug, that had been in the pile for 3 yr at an average flux of 2.79×10^{11} n/(cm^2)(sec), has been followed for 150 days through various thicknesses of Pb. The activity at 1 meter, as mr per hour per watt, is plotted versus decay time. Absorption curves are given for several decay times. (auth)

Refer also to abstracts 4284, 4293, and 4334.